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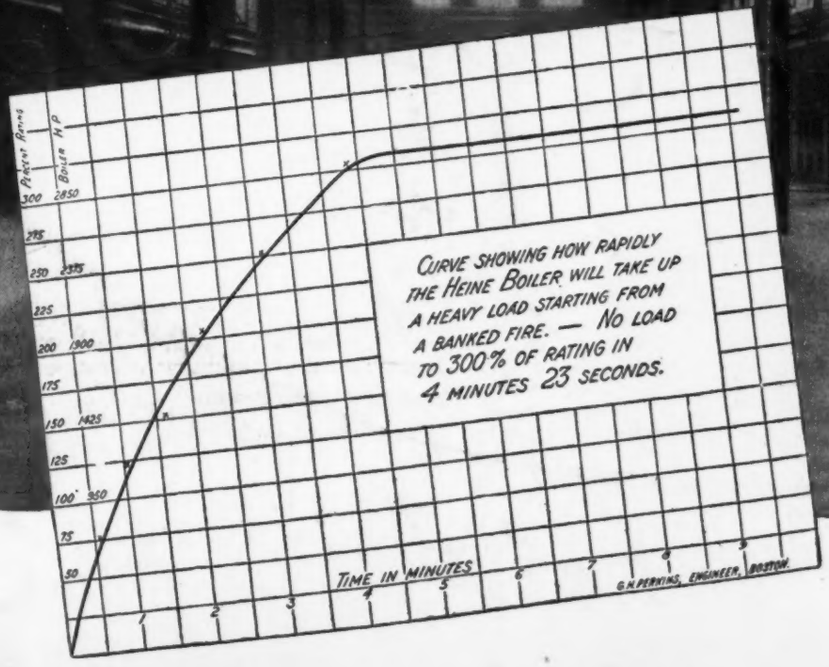

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# Electrical World

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## Chicago Conventions of 1885 and 1921

THIS year the convention of the National Electric Light Association in Chicago will afford an opportunity for many of its still living charter members to recall the historic circumstances of the first meeting in that city, thirty-six years ago, on Feb. 25, 1885. The comprehensive program of 1921 which was published in the ELECTRICAL WORLD of last week embraces the varied phases of an industry that touches the business and social affairs of 110,000,000 people. It reflects the vision of the small group of N. E. L. A. founders whose conception of electric service has been worked out in such a conspicuous way in the system of the Commonwealth Edison Company as to make Chicago an interesting observation point to all central-station men. Although less comprehensive in its scope, the N. E. L. A. program of 1885 in Chicago dealt with the needs of the central-station industry to meet demands then in sight which are today only multiplied by its present magnitude and complicated service requirements. Little did Chairman George S. Bowen at the first convention realize that he was uttering a classic remark when he asked this question in his opening address: "Can any man who has money to buy an electric light plant put it into operation, run it successfully and declare a dividend?" The discussions on this and allied subjects this year, amid historic surroundings, should attract an attendance of the younger executives who have been struggling with the problems of the local communities which will exceed all records of the eight previous Chicago meetings.

## New York's Commission and Politics

NEW YORK'S Governor in the few months he has been in Albany has achieved much. He has insisted on economy in state expenditures and by consolidations and pruning has applied the acid test to political incompetency and waste. In these respects he has shown himself an excellent executive and an unusual governor. Naturally, in haste to fulfill preelection promises, performance, however good, often falls short of intention. On the whole, the Public Service Commission law as revised is good, but the appointees so far must be accepted on faith. Evidently experience in public utility affairs did not count in their preferment. But a body composed of five Republicans appointed for a term of ten years at a salary of $15,000 a year and removable only by impeachment or legislation seems to us to offer an excellent opportunity for Democrats when they come into power to legislate the commission out of office and appoint five of their political faith. Thus the commission is thrust wholly into politics and all that that means. The only fortunate part of the affair is that the personnel which actually deals with public utilities is virtually unchanged.

## Electric Trucks on the Streets of Chicago

THERE is yet a tendency among engineers to regard the electric street truck in the light of its early operating days. Caroming around the highways and by-ways with bolts and nuts dropping by the wayside, batteries giving out at inopportune times, and various other failures often associated with pioneer development, the first "electric" may not have left a very wholesome operating record. However, to compare the old electric street truck with present-day equipment is to compare the old "one-lunger" gas car with present twin sixes.

Times have changed, and it would be well for electrical men themselves to realize the promising untouched field that lies before the modern electric vehicle. That this recognition is coming is shown by an article in this issue which deals with the growth of the electric truck business in Chicago. There the central-station company has seen the possibilities of this class of equipment, which fills a very definite place in the industrial and commercial development of a city and is helping to develop the business. Actual figures have shown that the electric vehicle is a real competitor of the gas car in short-haul, frequent-stop service. For this service it is conservatively estimated that 35,000 vehicles could be absorbed in Chicago alone. The 4,000 which are already operating produce a revenue of $400,000 annually for the Commonwealth Edison Company. The load occurs at an off-peak time and can be served at an attractive rate which at the same time brings a good return. What has been done in Chicago is also being done in New York, Boston, Philadelphia and other centers where central stations are wide awake to the opportunities of new business.

## Need of a Fixed Price for Wiring

ANYTHING that affects the prosperity and happiness of the local electrical family is very much the concern of the central-station company. Therefore the suggestion which "Kassandra" makes on another page of this issue is worthy of careful thought. The contractor, he says, should have a fixed price for all the ordinary run of small wiring jobs. He should save the time he now spends in estimating work on which the profit is too small to pay for the estimator's time. He should quit haggling over price and cutting profits

under pressure of the buyer's argument. There is much truth in this. All enlightened business men today have adopted the policy of fixed price; yet too many contractors still allow the customer to question the price on a wiring job. Here is a place where leadership by the utility manager may render a real service to the local electrical men. The contractors need a little guidance and help to enable them to make the practice of fixed prices a recognized standard among builders and home owners.

## Water-Power Regulation in Japan

APROPOS of the application of the federal water-power act it is not without benefit to become acquainted with the manner in which similar situations are handled elsewhere. In the current issue Charles B. Hawley gives a most instructive report of the regulations enforced by the Japanese government. In Japan all water powers are regarded as in the public domain, so that regulations affecting them apply to every hydro-electric enterprise. Local self-government is carried somewhat further than has been found advisable in the United States by the requirement that negotiations must be made with the local authorities on all agreements outside those affecting property acquired by eminent domain. The information required in the applications for concessions is rather notable, for not only is pretty complete evidence as to the financial backing of the scheme required, but also the completion of all the preliminary surveys up to the point where an exact financial estimate of the situation can be made. When the concession is granted work must be begun within one month and completed, unless the time be extended for good cause, within two years.

These provisions insure not only the complete working out of the project beforehand but the actual accomplishment of the financing of the scheme. In other words, the imperial government will not grant concessions to promoters who hope at some time in the future to interest somebody who knows somebody else who has real money.

## The Persistent Power-Factor Problem

SINCE motors have become a bigger and bigger factor in central-station load, power factor has become a more and more serious puzzle. It has often been considered in our columns and from many points of view, but the paper by C. J. Russell in this issue throws some new light on the practical side of the situation. In particular he gives the results of definite measurements in large industrial establishments which show the source of trouble with exceptional distinctness. While over-motoring is always with us, it is on the whole a considerably less serious matter than intermittent use, which results in a very low average power factor even when the characteristics of the motors are altogether satisfactory. Again, it turns out that in some plants low power factor is greatly influenced by bad starting conditions, generally due to squirrel-cage motors improperly used with insufficient starting equipment or none at all.

The electric service company thus has to face the certainty of furnishing a considerable amount of idle current, sometimes at bad points in the load curve, using up station and line capacity without proper recompense. The big problem is how best to effect a proper charge for this thankless service. In this country there has been no general agreement as to method, although commonly the motor charge is based on an assumed average power factor, nearly always higher than the motors give in practice. Now and then reactive current is segregated by a second meter and charged for directly or indirectly. In general all rates are based on the direct inclusion of factors convenient or easily measured, while the other factors, for varied reasons, are taken by general average. Given enough statistics of the customers' loads and measures, one could make a plausible schedule of rates nominally based on the area of their windows or their last year's income taxes. But in the case at hand it is certainly highly desirable to find the most convenient and direct way of recouping the central-station company for its increased service.

There are clearly too many possibilities in the causes and character of low power factors to include them all in a comprehensive and comprehensible formula, and the solution, as usual, resolves itself into the judicious choice of the straightforward facts upon which to base a power schedule. And this virtually turns upon methods of metering. With both kilovolt-amperes and kilowatts measured, it should be comparatively easy for the central-station company to fix upon a fair average price for reactive kva. and apply it as an additive charge. Given a good kva.-hour meter—practically an ampere-hour meter—an equally fair average could be reached. If anything, the latter method would be the simpler, and either would give the customer the benefit of any improvement in his practice. The French plan described by Mr. Russell is ingenious, but might fall foul of the same legal difficulty here that put the very reasonable two-rate meter out of service. In simplicity the kva. measurement for motors and the kw. measurement for lights would make a good combination, but the real problem is how to settle upon a concerted plan of action equally fair to all concerned—a problem all the more serious when interconnection is taken into account. For this involves the same question between companies that now stands between the central station and its customers—a very grave matter indeed in considering a superpower trunk line. Concrete data on the real cost to the station of providing and delivering reactive power should be gathered and formulated as soon as possible.

## Responsibility of Utility in Improving Home Lighting

ALTHOUGH the line of least resistance in extending the use of electric service in the home lies in promoting electric lighting, extending the use of adequate and appropriate lighting equipment still remains the most neglected phase of the business-building activities of most central-station companies. It seems to be considered that electricity is sure to be used for home lighting, and that fixtures therefore become a necessity and that their selection and installation may be left to the judgment of the customer. Whether this attitude on the part of central-station companies springs from carelessness or from ignorance of its effect on the degree of satisfaction that the completed installation will give, it is a deplorable one. The average home owner when selecting lighting units simply follows

custom and buys fixtures similar to those in his neighbors' homes or such as appeal to him as "stylish." The resulting lighting conditions are the greatest impediment to the progress of the industry.

Fixtures are found in common use of the "candle" variety, designed after the models of centuries ago, which were evolved as types affording the best support to the candles. The proper place for these types is a museum, where as examples of the constructive thinking of former days they might inspire present-day designers to appreciate the importance of independent thought in preparing fittings as well adapted to the modern illuminant, electricity, as those of old were to the light sources of their day. It must be recognized, too, that the incandescent lamps of today require a different treatment from the carbon lamps of yesterday. Wrongly installed, the large modern units are injuring the eyes, nerves and dispositions of many who misuse them, and they do not even serve the commercial purposes of augmenting the revenue of electric light and power companies, because, annoyed, perhaps unconsciously, by their brightness and alarmed by their energy-consuming characteristic, householders do not turn on the light till absolutely forced to do so and turn it off again at the earliest moment. Moreover, with the development of the tungsten lamp half or more of the lighting sockets in most pendent fixtures have become superfluous.

It is the responsibility of the central-station company to promote the use of the proper designs of fixtures, the proper sizes of lamps and the proper distribution of light, in accordance with the modern science of illumination. The properly educated customer will probably consume more electricity and buy more lamps in lighting his house than he did before, but he will get real value for his money in the increased ease of seeing, reading and working. Under such circumstances, the electric light bill in the household expense budget, which is comparable in amount with the cost per month of cream used in coffee, will be transferred to the pleasure column, and there will be a direct reward to the companies in return for a better service rendered which if not actually shown in increased income will certainly help toward bringing about right relations with the customer.

## Rural Business Must Stand on Its Own Feet

UNPROFITABLE extensions are sometimes hard to guard against, particularly in new fields where the future growth of the territory is hard to foresee. This difficulty has been a big one in the rural service situation. It was faced earlier in the irrigation problem of the Rocky Mountain and Pacific Coast regions. The safeguards that have been built up as the result of experience are recounted elsewhere in this issue in an article analyzing the principal features of some of the Western irrigation schedules. In taking up such problems the assumption is ordinarily made that the business must first be taken on with some loss that will be later covered by the growth of the demand. This assumption has generally proved correct in urban territory, but has not worked out in rural sections, because the possibility of very rapid growth does not exist.

In rural territory the number of consumers per mile that can be obtained is decidedly limited. If this were not so the territory would cease to be rural. With the limitation of the number of consumers the fact of a high investment per consumer must be recognized. The only directions in which growth can be expected are the extension of lines and the increasing of individual consumption. Extension of lines does not materially lower the average investment cost per consumer, and the education of the consumers to the larger individual use of energy is a slow process, particularly as it must proceed hand in hand with the development of farm machinery that will utilize electric power to the fullest extent. Too great dependence on future growth to make rural extensions profitable is therefore a serious error. The fact seems to be that the fundamental development places the business in a class by itself, and unless the principle of making other classes of business bear the development cost is admitted as correct, rural business must be made to stand on its own feet from the start. The irrigation experience of the West seems to justify proceedings in this way, and irrigation practices will bear careful study in the solving of the farm problem.

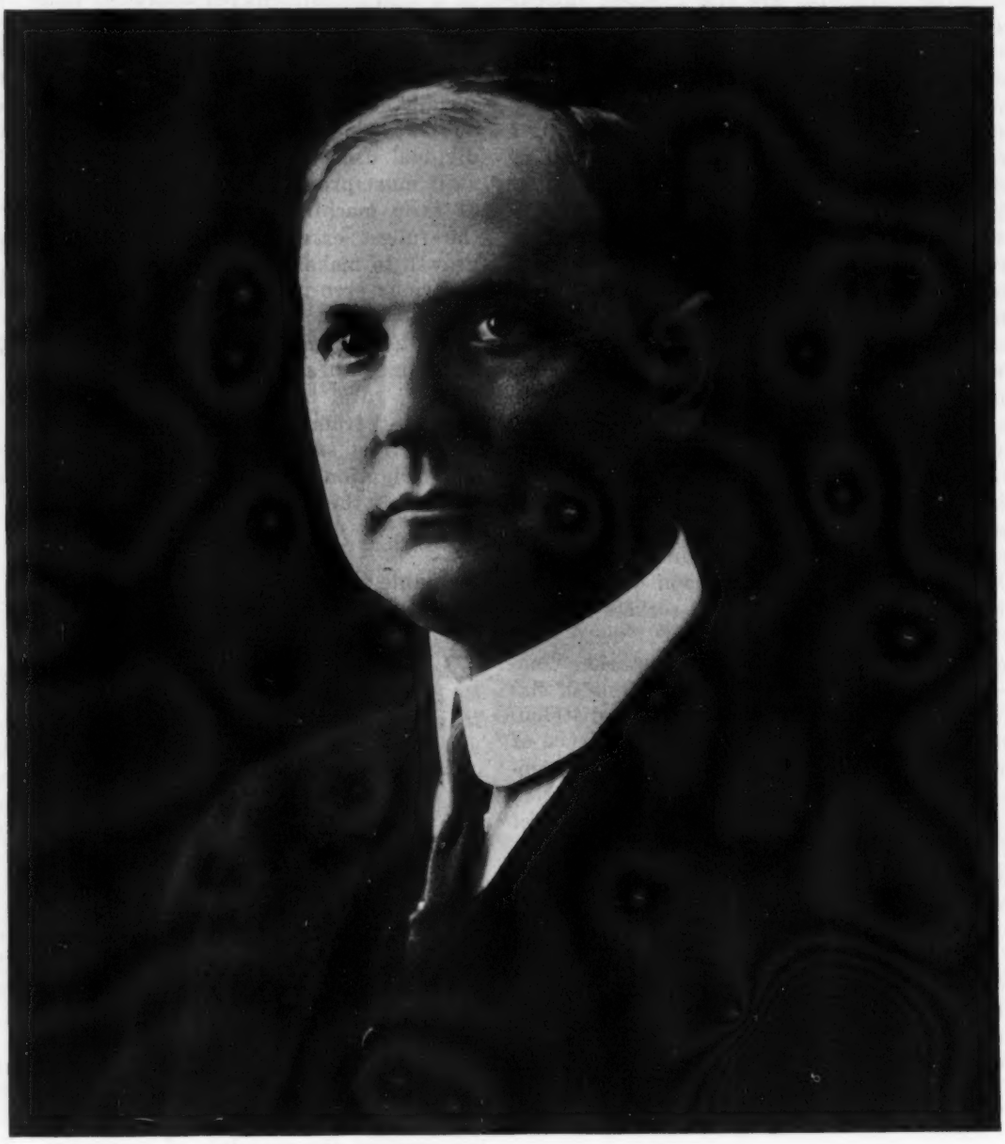
## Valuable Contribution on Multiple Telephony and Telegraphy

A PAPER that makes a notable contribution to the subject of multiple telegraphy and telephony, by E. H. Colpitts and O. B. Blackwell, is concluded in the May *Journal* of the American Institute of Electrical Engineers. It is shown that line conductors may be worked at higher traffic densities by the use of carrier currents of suitable frequencies. The method thus far has proved particularly economical for long toll lines where it is important to make maximum use of the large investment in line equipment.

Four essential principles are involved in the system discussed: First, impressing one or more modulable frequencies on the line; second, the modulation of such a frequency over a certain frequency range in accordance with signals to be transmitted; third, the preservation of the modulated frequency range in the prescribed channel, by the use of suitable filters therein, and, fourth, the demodulation of this prescribed channel frequency range in the receiving apparatus. The filtering employs the principle of resonance. The modulation and the demodulation employ dissymmetrical action, or non-linear characteristics. All four of these elements, except the filtering, depend upon the use of vacuum tubes and are illustrations of vacuum-tube engineering.

Since the objects of the system are to make one pair of wires capable of serving for a considerable number of telephonic and telegraphic circuits, a number of different sets of apparatus must be concentrated upon each pair of lines, and the sets must be maintained in independent good order. There would be fewer lines and linemen, but more instruments, mechanics and electricians. Hence more technical skill is demanded in the stations. Incidentally, each pair of lines in such a system would have to be carefully insulated, balanced and transposed, so that a greater amount of attention would have to be paid to the installation and upkeep of the conductors.

The paper contains a wealth of new technical material and shows evidence of a vast amount of research, design and construction.



## Franklin Thomas Griffith

*A public utility executive who for a number of years has fought for water-power legislation that will permit the economical development of Western resources*

WHILE the engineer of the West, noted for his creative imagination, has distinguished himself by epoch-making achievements in design and construction, it has often remained for the analytical mind of the lawyer, executive and economist to carry the engineer's work to fruition. This Franklin T. Griffith has done. First as attorney he made great strides in codifying laws governing the development of water powers, and later as president of the Portland (Ore.) Railway, Light & Power Company he has been applying his sympathetic understanding of human nature to smooth the way for the utility in best serving the public. When the national water-power laws were being formulated, the experience and advice of Mr. Griffith were widely sought, and he gave largely of his energy in constructive thought on this legislation. Then and since, as chairman of the water-power development committee of the National Electric Light Association, he has untiringly worked to bring about far-sighted interpretations of these laws with workable rules and regulations so that the most beneficial results shall be gained.

Mr. Griffith was born in Minneapolis, Minn., in 1870, but before long moved to California, where he attended the public schools. As a boy he began to work in the paper-manufacturing industry and soon became familiar with every phase of that business. At the same time he took up the study of law and by close application in his extra hours he became qualified for admission to the bar in 1894, at which time he opened a law office in Oregon City. During the next five years he was city attorney and legal adviser for paper-mill interests and the Portland General Electric Company, a predecessor of the Portland Railway, Light & Power Company. For these companies he handled all matters pertaining to water-power leases and rights. It was during this period that a water code was being advocated for the State of Oregon, and his years of intimate knowledge of this subject caused him to play a leading part in the enactment of the code, which was adopted in 1909.

In 1909 he opened law offices in Portland, continuing to act as attorney for the Portland Railway, Light & Power Company. This closer touch with the affairs of that company led to his election as its president in June, 1913. Since becoming president there has been a period of lean years for public utilities. Nevertheless Mr. Griffith has held to his firm belief that better times are in store, and he has done much in promoting a more favorable public sentiment toward utilities and in bringing about a recognition by the public of the need for granting utilities rates sufficient to meet increased operating expenses.

In 1920 he was elected vice-president of the National Electric Light Association. He was later elected president of the Northwest Electric Light & Power Association, which is now active in a cooperative movement to secure a wider appreciation of the fundamental position of the hydro-electric industry in the West.

# How Should Power Factor Be Handled?

## Rates Should Take Into Consideration Added Service Rendered When Reactive Power Is Supplied—Over-Motoring Not the Sole Cause of Low Power Factor—Foreign Countries Have Good Method of Approach

By CHARLES J. RUSSELL*
*General Commercial Manager Philadelphia Electric Company*

TWO FORMS of service are being supplied by the central station to the user of alternating-current load, one of which consists in the supply of active power and the other in the supply of magnetizing current, this latter form of service often being supplied without reference to its amount or to the expense involved. Some attempts have been made to designate the amount of gratuitous service which will be supplied along with the paid-for service, but in this country there has been no standard set.

Both capital and expense are involved in the production and delivery of reactive power to any customer. The amount of capital depends upon the capacity required, and the expense depends upon the distance and conditions of transportation as well as the number of kilovolt-ampere-hours required. These two variables affect the cost of service, and as they may be of material importance as between customers they should have careful consideration.

The central-station company may continue to supply magnetizing current in the future or it may decide to limit such supply. On the other hand, it may decide to compel the customer to supply all or a part of the magnetizing current necessary for his operation. Such decisions are of great economic importance on account of their relation to the cost of service. It is the further belief of the author that uniform treatment of this economic factor is of the utmost importance to the central-station industry.

### EXISTING PRACTICE IN THIS COUNTRY

In this country the diversity of opinion upon the subject of power factor has found expression in a great variety of regulations and rates covering alternating-current power installations.

One point of uniformity and importance may be noted in all these regulations—namely, the designation of some standard lower than unity power factor to which the installation must conform, either as an average condition or at the time of periodic tests. This standard varies among companies from 70 per cent to 95 per cent and with some companies covers the same range according to the size of the installation or demand. In virtually all cases the rate structure is such that service is supplied below the standard under a penalty. In only a few cases is a bonus provided in the rate for a power factor better than the standard, and it may be said consequently that in general practice the standard represents the point at which the price of energy is a minimum.

Some of the newer as well as a few of the older rates recognize the additional expense involved in supplying more than a certain percentage of reactive power by increasing the kilowatt-hours charged for when the power factor is below the standard. No case in this country has come to the attention of the author where a direct charge for reactive power is included in a rate for power service.

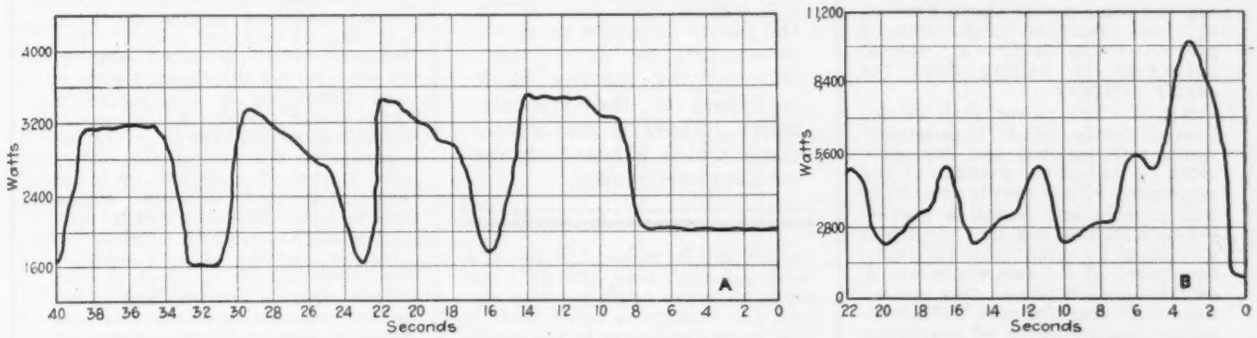



FIG. 1—CYCLIC DEMANDS FOR POWER CONSTITUTE A MORE SERIOUS CAUSE OF LOW POWER FACTOR THAN OVER-MOTORING

### ENFORCEMENT OF POWER-FACTOR REGULATIONS

Power-factor regulations have not been generally enforced in this country principally on account of the lack of standard practice in measurement. The practical difficulties met with and the necessity for the development of standard methods and instruments have been reviewed so fully in articles appearing in the ELECTRICAL WORLD that further discussion on these points is not necessary. The present tendency is in favor of the use of watt-hour meters connected to measure the reactive power, the power factor being determined by the relation of the reactive power to the active power registered by the regular watt-hour meters. The installation of printometers in connection with the meters registering reactive power as well as with those measuring active power presents a very satisfactory method of obtaining data from any installation.

The results from a large number of tests made in this manner by the Philadelphia Electric Company present

*As chairman of the power factor committee, Association of Edison Illuminating Companies, and through years of study of this question for the Philadelphia Electric Company, Mr. Russell is highly qualified to speak with authority on the subject of power factor.—EDITOR.

# A French Contract that Equitably Handles a Variable-Power-Factor Demand*

Art. 1. The power will be furnished by the supply company continuously, day and night, including Sundays and holidays, in the form of three-phase current at 25 cycles, without interruption except for causes beyond its control and subject to reserves and exceptions as mentioned in Article 2.

Art. 2. The voltage of the power measured at the incoming service shall be as constant as possible; it shall in no case be below 5,200 volts nor above 5,650 volts. The voltage variations allowed above shall be neither sudden nor repeated but shall occur slowly and progressively, the voltage at outgoing bus of the generating station remaining constant. The installation of the customer shall be made and operated in such a manner as not to interfere in any way with the service to the other customers of the supply company.

### Maximum Demand Fixed

Art. 3. The maximum power which the customer will be entitled to draw is fixed at 815 kva. No addition to the installation increasing the total power above fixed of 815 kva. shall be made without previously securing a special agreement in writing from the supply company.

Art. 4. The power shall be delivered inside of a high-tension vault, well inclosed and dry, provided by and at the expense of the customer. The supply company will provide and install a service between its line and said vault and will install therein the following equipment at its own expense: A switch on each phase; two meters with their transformers and accessories; one indicator of maximum amperes per phase; all connections, bus and conductors, insulators and other necessary equipment up to the entrance to the vault.

The indicators of maximum amperes will be installed one on each phase; the reading of each of these instruments shall be added, and in order to determine the power in apparent kilovolt-amperes an average voltage of 3,200, corresponding to the average voltage between phases of 5,500 volts, shall be taken. The supply company reserves the right to replace at any time it so chooses these ammeters with one or more recording instruments. The above equipment will remain the property of the supply company. For the rental and upkeep of the above equipment the customer will pay the supply company the sum of —— per month. The agents of the supply company shall have the right of access to the said high-tension vault and to the above-named equipment at any time. Any interference with the exercise of this right may be penalized by a severance of the power supply to the customer. The meter will be accessible without the necessity of entering the high-tension vault. One of the keys of the vault will be left with customer.

Art. 5. In addition to the price of the kilowatt-hours of true energy used, the customer shall pay for all reactive power consumed. The reactive energy shall be measured with a special meter calibrated in units corresponding to the kilowatt-hours in such a way that the cosine of the angle (phase-angle difference between voltage and current) being equal to 0.707, the meter will register as many units of reactive power as the meter of true power registers kilowatt-hours. To simplify computation of bills, instead of charging the reactive energy at a different rate per kilowatt-hour, 30 per cent of the kilowatt-hours registered by the special meter shall be added to kilowatt-hours of true power consumed and the total shall be called kilowatt-hours of "complex energy." This complex energy

**THE power rate consists chiefly of two elements: a rate for complex energy and a demand charge based on the highest kva. load during the year. Complex energy is determined by adding one-third of the reactive hours registered to the kilowatt-hours. There is also a coal clause which is based on the complex energy used.**

(which will be reduced to the kilowatt-hours of true energy every time the phase angle between current and voltage is zero) shall be paid by the customer to the supply company at the tariff rate of —— centimes per kilowatt-hour.

In case the customer shall change his installation so that the cosine of the phase angle shall permanently remain between 0.9 and 1.0, the reactive energy metered shall not be billed, but shall be charged whenever this condition is not fulfilled. The meter of reactive energy shall be provided with a device preventing its operation in a reverse direction.

The rate of the power supplied shall consist of two elements: (a) A rate of —— centimes per kilowatt-hour of complex energy as defined in the preceding paragraphs; (b) a stand-by charge of —— francs per year per kilovolt-ampere of maximum apparent power demand to be paid monthly in twelfths, the kilowatt-hours of maximum demand to be determined as follows:

The maximum apparent power for the purpose of billing the stand-by charge shall be the highest reading registered throughout the year by the instruments (ammeters and voltmeters). To determine the monthly stand-by charge the highest indication from the first of the year to the time of each reading shall be taken. During the month of January of each year an adjustment shall be made of the charges made for the twelve preceding months, based on the highest reading of kilovolt-amperes registered.

Art. 6. In addition to the charges named in the preceding article, the supply company shall be indemnified by the customer for any increase in cost of coal. This indemnity shall be at the rate of —— centimes per kilowatt-hour of complex energy for each one franc increase in cost of coal above —— francs per ton. The above cost of coal shall be the average cost of coal f.o.b. the stations of the supply company for each period of three months during the year. These average prices shall, until new order, be those fixed by the fuel administration in charge of the distribution and allocation of coal to the public utilities.

For simplicity of accounting, the above indemnity shall be billed each month and shall be included in the bill for kilowatt-hours of complex energy supplied; and in case of non-payment of this indemnity the customer shall be liable to the same conditions as for the non-payment of complex energy. The indemnity shall be billed monthly on the base of the average cost of coal prevailing in the preceding three-month period. In the month following each quarterly period the increase or decrease in the difference in cost of coal shall be billed and settlement effected within fifteen days. However, and by special mutual agreement, during the first ten months of this contract the indemnity for increase of coal prices shall be charged and added to the kilowatt-hours of true energy instead of kilowatt-hours of complex energy.

### Minimum Consumption Guaranteed

Art. 7. The customer guarantees to the supply company an annual minimum consumption of 600,000 kw.-hr. of complex energy and any shortage in this consumption shall be paid for at the rate of —— centimes per kilowatt-hours. During the first and last year of this contract the above guarantee shall be reduced to the pro rata of the number of days of the contract. In case of strike, complete or partial, or of fire, it is understood that the above minimum consumption of kilowatt-hours shall be waived to the extent of the pro rata of days involved.

Art. 8. In case of disagreement as to the interpretation of this contract, the matter shall be brought before the courts of jurisdiction of the department in which the service is situated, or if the parties hereto prefer, shall be amicably settled by arbitration. All additional taxes over and above the present ones hereinafter levied and affecting the cost of the commodity supplied under this contract shall be borne by the customer.

*Translated by George Roux.

some valuable information upon the power factor in typical installations. In connection with instantaneous tests made of individual motors used in various industrial operations the data are especially illuminating as to the power factors found in ordinary practice.

### OVER-MOTORING NOT SOLE CAUSE FOR LOW POWER FACTOR

Let us first consider the common statement that the outstanding cause of low power factor is the excessive capacity of the motors installed for carrying on industrial operations. This statement is based to a great extent upon the practice of individual drive, which has been widely advocated and very gradually adopted. There can be no doubt that there are many installations in which over-motoring has been practiced, but the results of a very large number of tests in Philadelphia show that the alleged abnormal size of motors may be traced directly to two causes—namely, the requirements for high starting torque and the heavy demands at maximum loads which do not exist during a large percentage of the working day.

The capacity of any motor is naturally determined by the estimated maximum of power required for its operation. The load cycle of industrial plants is seldom such as to require the maintenance of maximum power requirements throughout the working period. The questions of inertia, friction, weather conditions and human fatigue all have a bearing upon the relation between maximum and average power requirements during a working day. It is a well-known fact that most industrial operations are cyclic in power demands, ranging from a minimum to a maximum over intervals of from a fraction of a second to longer intervals.

Fig. 1A is a reproduction of a graphic record made by a high-speed specially designed instrument. The chart shows the current consumed by a 5-hp. motor during a forty-second interval in which four non-automatic cutting operations were completed. It will be noticed that the power demands had a range of more than 50 per cent of the maximum. As the reactive power required over this interval varied but slightly it can readily be seen that the average power factor of this motor will be much lower than would be the case if the power demand were a straight line at the maximum.

Fig. 1B is also a graphic chart from a non-automatic operation, showing the current consumed in starting a lathe with work in place, making two cutting and one boring operation and cutting off. This chart also shows a wide variation in power demands during the cycle of these operations, and that the average power factor of the motor will be materially lower than that anticipated from its maximum demand for power.

The two operations illustrated in Figs. 1A and 1B are typical of many found in the metal and woodworking trades. It is consequently evident that other influences besides over-motoring affect the power factors found in industries where continuous cyclic changes in the demand for power occur. In fact the load factor of any motor measured over the hours it is in operation determines the power factor. In practice load factors of from 50 to 60 per cent during the hours of full operation are quite common. Several tests made on plants with absolutely correct motoring show power factors of from 70 to 75 per cent.

The printometer tests made with watt-hour meters, one set registering kilowatts and the other connected to measure reactive power, bring out a number of interesting and important points in connection with the question of method and time of power-factor measurement.

Fig. 2A is a graphical representation of the printometer results on a typical day in a pressed-metal plant. Synchronous apparatus is operated continuously in this plant for corrective purposes, and the result is an aver-

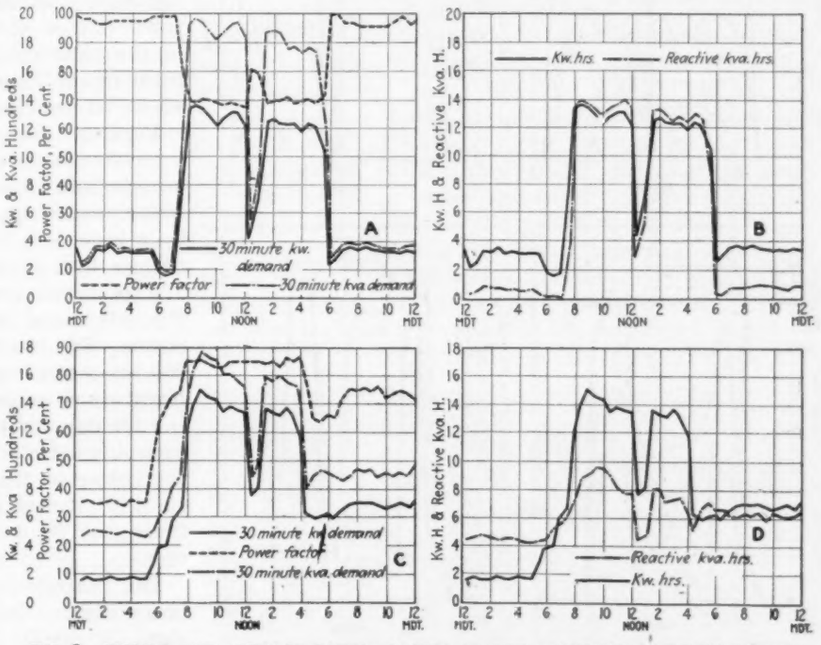



FIG. 2—WHILE THE AVERAGE POWER FACTOR IS THE SAME FOR BOTH OF THESE INSTALLATIONS, THE DEMAND FOR REACTIVE POWER IS QUITE DIFFERENT

In A are shown the printometer records for operations in a pressed-steel plant, while B shows the reactive kilovolt-ampere hours and kilowatt-hours required in the same plant. Similarly C and D show the load conditions in a steel-working plant.

age power factor considerably higher than that existing during the period of maximum demands. The maximum thirty-minute kva. demand occurs at 8:30 a.m. and exceeds the maximum kw. demand, which in this case is simultaneous, by 44 per cent. In fact the average thirty-minute kva. demand over the period of heavy load exceeds the average thirty-minute kw. demand by almost 44 per cent, the power factor ranging close to 70 per cent during that period. Owing to the use of synchronous machines the average thirty-minute kva. demand over the twenty-four-hour period exceeds the average thirty-minute kw. demand by about 29 per cent, and the average power factor for the day is a little over 80 per cent.

Fig. 2B shows the relation between the reactive kilovolt-ampere-hours and the kilowatt-hours derived from the records on which Fig. 2A is based. It will be noticed that the reactive power during the period of heavy load is virtually equal to the active power, whereas during the period of light load the synchronous apparatus has supplied a large proportion of the necessary magnetizing current, with the result that the total

reactive power (kilovolt-ampere-hours) is about 81 per cent of the total kilowatt-hours.

The chart shown as Fig. 2C is taken from printometer records of a typical day in a large steel-working plant, and this with the accompanying Fig. 2D illustrates a condition, as far as results are concerned, precisely opposite to those shown in Figs. 2A and 2B.

The installation shown in Figs. 2C and 2D includes quite a large capacity of synchronous motors. It will

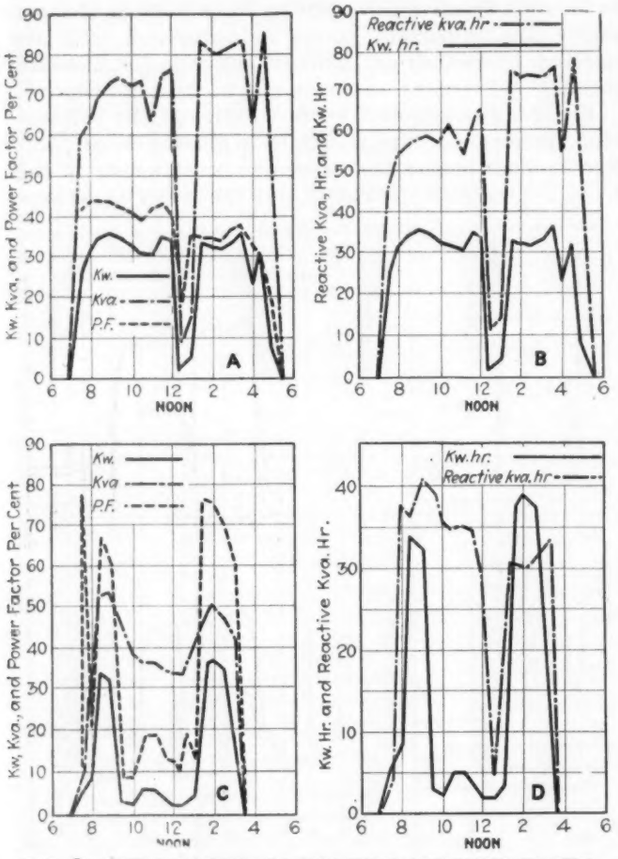



**FIG. 3—POWER FACTORS DO NOT VARY ACCORDING TO THE DEMANDS AS SHOWN BY THESE LOAD CONDITIONS**

Load conditions in a textile plant are shown in A and B, while C and D show power requirements of a woodworking establishment. Note the difference in power factor due to varying demands and different grouping of machines in operation.

be noted that the maximum thirty-minute kva. demand, which occurs at 9 a.m., exceeds the maximum thirty-minute kv. demand, which is simultaneous, by only 16 per cent. In fact the excess of the kva. demand over the kw. demand during the period of heavy load is about on that order. Because of the smaller use of synchronous motors at night the average thirty-minute kva. demand over twenty-four hours exceeds the average thirty-minute kw. demand by 30 per cent.

Fig. 2D shows the relation between the reactive power kilovolt-ampere-hour and the kilowatt-hour. This shows that during the period of heavy load the reactive power is much less than the active power, but that during the hours of light load the excess of reactive over active is such that in the twenty-four-hour period the kilovolt-ampere-hours are 83 per cent of the kilowatt-hours, differing but slightly from Figs. 2A and 2B.

From these two sets of figures may be drawn the entire story of the question of time and method of measurement. In both cases the results under power-factor regulations dealing with average power factors are almost the same. In the first case the customer has required large capacity and a large ratio of reactive power during the hours of heavy load. In the second case the capacity and ratio of reactive power have been relatively large during the hours of light load.

Figs. 3A and 3B are drawn up from the printometer figures for a textile plant. The maximum thirty-minute kva. demand on this day occurred at 4:30 p.m. and exceeded the thirty-minute kw. demand, which is shown at 3:30 p.m., by 142 per cent. The average thirty-minute kva. demand over the period of test is 133 per cent greater than the average thirty-minute kw. demand. The curve of kw. demand is typical of many textile plants, the morning maximum seldom being equaled until 3 to 3:30 p.m.

Fig. 3B shows the relation between the active and reactive power, the reactive kilovolt-ampere-hours being more than 200 per cent of the kilowatt-hours. The power factor of many textile plants is very low. One of the most modern and best equipped shows a maximum power factor of 78 per cent, with an average of about 70 per cent.

Figs. 3C and 3D illustrate the power conditions in a woodworking establishment. The maximum thirty-minute kva. demand occurs at 9 a.m. and exceeds the maximum thirty-minute kw. demand as shown at 2 p.m. by a little less than 40 per cent. The average thirty-minute kva. demand over the period of test is almost 120 per cent greater than the average kw. demand. Fig. 3D shows the relation between active and reactive power. The reactive kilovolt-ampere-hours are almost 200 per cent of the kilowatt-hours. These results are interesting as showing the difference in power factor during the day due to varying power demands and different groupings of machines in operation. Maximum demands for power on the various machines installed in a plant of this character are usually of short duration, and there may be a material interval between these maximums.

The charts herewith reproduced are selected from a large number taken in typical installations of various size. A careful study of their important characteristics will throw much light on the question of power-factor measurement. Industrial power factors do not vary in accordance with the demand, but may have considerable variation according to the combinations of the apparatus which creates the demand. Average power factor determined by continuous registration may not give the central-station company a correct answer on the points which are really of importance.

Two measures are necessary in order to give sufficient data to deal with existing power factors in industrial installations. The first is the excess of the kva. demand over the kw. demand. The second is the relation between kilovolt-ampere-hours and kilowatt-hours during the period of normal operation.

### FOREIGN RATES ON BASIS OF COMPLEX ENERGY

In considering the question of foreign practice relative to power-factor regulations and measurements three points are evident which have had a great influence in the present condition of affairs. The first of these is the fact that many of the foreign power developments consist of relatively small water-power plants. To generating stations of such a nature power factor is a most important subject. The question of regulation and rates has been thoroughly discussed in European countries for many years. As a matter of fact Professor

Arno urged ten years ago international action on a proposed formula to fix the price relation between active power and reactive power. The second point which has had an influence upon the power-factor situation abroad has been the relation between the demands for power and those for light, the former in many cases being far in excess. The third point was the great demand for power during the war, which resulted in an intense drive to make available every kilowatt of capacity.

Existing practice may be said in general to represent the following standard methods:

Stand-by charge based on kilovolt-amperes.

Time of measurement—usually that of the greatest kva. demand in the year.

Energy charge—price per kilowatt-hour for active power plus reactive power at a variable figure.

There is quite a variation in the power factor specified as standard in the rate schedules abroad, the figures covering about the same range as in this country. It may be of interest in this connection to mention the prevailing German practice of establishing the standard power factor at 80 per cent. For power factors other than 80 per cent the following percentages of additions or reductions in the kilowatt-hours are made: Unity power factor — 9.37 per cent; 90 per cent — 3.37 per cent; 70 per cent + 6.75 per cent; 50 per cent + 24.5 per cent.

There has been quite a general tendency abroad to charge per kilowatt-hour, while in some cases there is an additional charge per kilowatt-hour when the reactive power is more than 75 per cent of the active power and a reduction per kilowatt-hour when the reactive power is less than 75 per cent of the kilowatt-hours.

In Marseilles and vicinity the standard power factor is established at 85 per cent and the standard power contract specifies that for any variation in power factor the kilowatt-hours billed will be automatically increased or decreased from the hours consumed. With unity power factor the kilowatt-hours are decreased for billing purposes 7.8 per cent, at 95 per cent power factor 4.1 per cent, and at 90 per cent 1.9 per cent. For power factors below the standard the kilowatt-hours are similarly increased. For the purpose of simplifying the reading and computation of the complex energy charge a special meter has been devised consisting of two meter elements in one case, each with its own dial, one registering the active and the other the reactive power. The shafts of these two elements are, through a differential and a train of gears, connected to a third dial which registers the resultant kilowatt-hours for filling purposes. At the power factor selected as standard the third dial measures precisely the same as the kilowatt-hour dial; for lower power factors it registers more and for higher power factors less in accordance with a table of percentages designated in the agreement with the customer. The statement is made that these meters are being adopted by several of the large central stations in France. The advantage of direct and simultaneous readings of active and reactive power, thus making it possible to determine the customer's power factor over any given interval of time, makes this meter of particular interest.

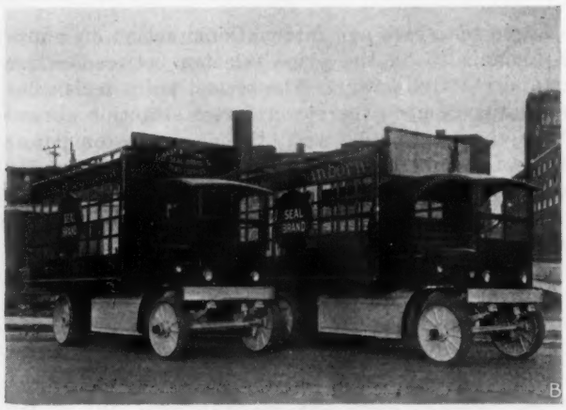
One point worthy of consideration has been brought out by the interconnection of a large number of moderate-sized systems in the water-power sections of Europe—namely, that power factor is one of the most important questions in the interchange of power. It is possible that future developments along this line in the United States may cause renewed interest in the subject.

The work done by the special joint committee of the American Institute of Electrical Engineers and of the National Electric Light Association is widely known. The work done and now under way in the Association of Edison Illuminating Companies has not had such wide publicity. A special committee appointed by President Walter H. Johnson of this association is now gathering data and information abroad as well as in this country for a later report on power factor. The special committee of the Association of Edison Illuminating Companies requests general consideration of the subject and the co-operation of all interested in power factor.

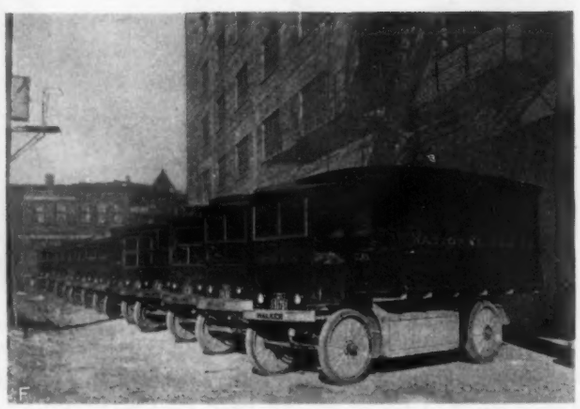
## Electric Cableway Helps Build Scout Cruisers

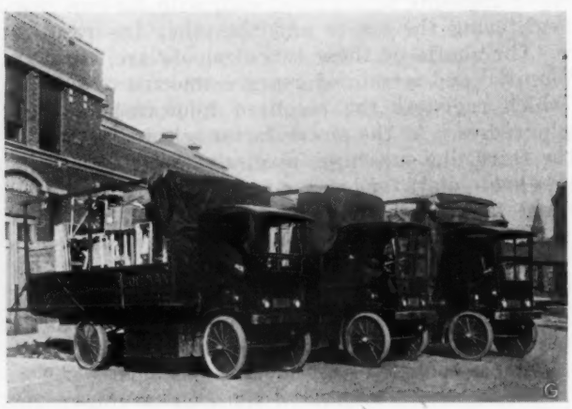
SCOUT cruisers for Uncle Sam's navy are being built at the Fore River yard of the Bethlehem Shipbuilding Corporation, Ltd., with the aid of the electric cableway shown in the accompanying photograph, said to be the first of its type to be installed on the North Atlantic Coast. The comparatively narrow space available for handling plates and other materials over the shipway shown led to the selection of this type of equipment in place of the usual traveling crane and boom hoist. Two cableways are provided, each having a lifting capacity of 3 tons at a rate of 200 ft. (61 m.) per minute, with a forward or aft movement of 600 ft. (183 m.) per minute. Each is driven by a 50-hp., 250-volt direct-current motor, controlled by an operator stationed in a cabin at the head of the shipway and directed by electric bell signals from an observer whose post is on a tower on the cruiser structure. The cableways are supported on head and tail towers 145 ft. and 102 ft. (44 m. and 31 m.) high respectively, the span between towers being 700 ft. (215 m.). The entire erection job was accomplished in three weeks, including the electrical installation.

CABLEWAY AT FORE RIVER YARD, BETHLEHEM SHIPBUILDING CORPORATION, LTD.



## Diversified Industries Are Using Electric Trucks for Light and Heavy Work





A—Nationally known firms such as the United Cigar Stores Company have adopted the electric vehicle.

B—Chase & Sanborn make coffee deliveries with "electrics."

C—Well-known clothing manufacturers such as Hart, Schaffner & Marx are moving their product with battery power.

D—Modern electric trucks are not limited as to body sizes but can compete when bulky loads are to be handled. The Hebard Storage Warehouse Company handles all classes of moving work.

E—Sixteen ice-cream companies are using or have on order about 200 electric delivery wagons. The fleet of the Anderson & Gooding Ice Cream Company is shown.

F—The National Tea Company operates a truck fleet for city delivery work.

G—In work where loading and unloading are slow jobs the demountable body increases the truck efficiency. The Hartman Furniture & Carpet Company employs such a scheme with "electrics."

# Electric Truck Gaining Favor in Chicago

## Commonwealth Edison Company Garage System a Factor in the Growing Use of This Vehicle—Consumption of Energy Compared with Amount Taken by Commercial and Residential Customers

IN CITIES WHERE THE USE OF ELECTRIC VEHICLES HAS BEEN FOSTERED THE ELECTRIC LOAD HAS PROVED DECIDEDLY WORTH WHILE

IN CHICAGO there are more than 4,000 electric vehicles in operation. Of these about 90 per cent obtain their power from the Commonwealth Edison Company and by so doing produce a revenue of almost $400,000 per annum for the company. The income derived from electric vehicles is sufficient to pay one month's dividend on the capital stock of the company, although it is only 1 per cent of the total income. These facts serve to emphasize the value of the electric truck as a producer of revenue, and revenue derived almost entirely between the hours of 10 p.m. and 6 a.m., or in other words without making any additional demand upon the generating station.

Chicago's central-station company has not adopted a battery rental or exchange system such as has come into vogue in other cities where the electric vehicle has made rapid headway. The company has, however, adopted a garage service which has acted to encourage the use of the electric vehicle among those who were at first somewhat skeptical or who had neither the inclination nor the facilities to care for their own trucks. The company has, further, supported the electric truck manufacturers by offering a favorable power rate for off-peak charging, by encouraging charging stations in strategic locations and by maintaining a department for fostering interest in electric trucks and tractors.

### Good Revenue for Size of Connected Load

Two outstanding facts wherever the electric truck is largely used are that as a form of connected load the truck is insignificantly small and that as a producer of revenue the load is, none the less, worth while. The average electric truck represents a connected load of about 6.9 kw. Because this load comes on during the off-peak period between 10 p.m. and 5 a.m. it produces no problems in the way of increased generator capacity. The load being comparatively small but long and steady—about six continuous hours nightly—the total monthly kilowatt-hour consumption is considerable.

Chicago's electric vehicle fleet, large as it is, gives so small a connected load that, with all trucks charging, the load can hardly be distinguished on the twenty-four-hour load curve. Only on the two feeders supplying the two largest garages is the load noticeably apparent. Yet this same load is bringing in a revenue to the Commonwealth Edison Company of approximately $400,000 annually.

The average monthly consumption per electric vehicle in Chicago is 700 kw.-hr. The average Chicago residence consumes 34.3 kw.-hr. per month, and the average store or commercial customer consumes 165 kw.-hr. per month. In other words, the electric truck uses in one night almost as much current as the average residence uses in an entire month, with the very great difference that the truck makes its demand upon the central station when other demands are minimum.

Large as is Chicago's electric truck fleet, comparatively, it is only a small proportion of what it might be. Upon a conservative estimate, there is a potential demand for 35,000 electric vehicles in the Chicago territory. In other words, only about 11 per cent of the possible electric truck users are actual users.

A study of electric truck applications in Chicago shows that certain lines of business particularly have been quick to turn to the electric delivery truck. Ninety-five per cent of the electric vehicles sold are repeat orders, which is one explanation for the large number of vehicles owned by single concerns. Another explanation is that economies by a competitor necessitate similar economies by those that follow the same line of business. The Commonwealth Edison Company has carefully investigated the various lines of business and their

# Electric Vehicles Contribute $400,000 to the Yearly Revenue of the Commonwealth Edison Company, Chicago

THE average monthly consumption per electric vehicle is 700 kw.-hr. as compared with 35 kw.-hr. for the average residential load and 165 kw.-hr. for the average commercial installation. An average of installations shows that each truck represents a connected load of 6.9 kw., which is low compared with the average energy consumption per truck. As the load is entirely off peak, the business is very attractive.

According to conservative estimates, there is a potential demand for 35,000 electric vehicles in Chicago, although at present only 4,000 are in operation. As shown in the accompanying table, certain lines of business have taken up electric transportation more extensively than others. Short-haul, frequent-stop work such as that for the department store or the grocer is especially the field of the "electric."

Although the electric vehicle users receive a low off-peak rate, still the total yearly revenue is $400,000. More than half of this revenue is from street trucks.

AVERAGE MONTHLY ENERGY CONSUMPTION FOR TRUCKS IN DIFFERENT LINES OF BUSINESS

| Business | Size of Truck (Capacity) | Kw.-Hr. per Month |
|---|---|---|
| Waste-paper collection | 2 tons | 1,000 |
| | 5 tons | 1,200 |
| Wholesale hardware | 3½ tons | 1,300 |
| Teaming, short hauls | 5 tons | 1,000 |
| Teaming, short hauls | 3½ tons | 1,200 |
| Ice delivery | 3½ tons | 1,000 |
| | 5 tons | 1,100 |
| Steel delivery | 1½ tons | 600 |
| | 2 tons | 1,000 |
| Wholesale grocery | 5 tons | 1,200 |
| Wholesale candy | 2 tons | 750 |
| | 5 tons | 850 |
| Retail candy | ½ tons | 250 |
| Retail fish delivery | 2 tons | 800 |
| Pie and confectionery | 1 tons | 350 |
| Bakeries | ½ tons | 700 |
| Passenger transfers and buses | 12 passengers | 600 |
| | 22 passengers | 700 |
| Laundries | 750 lb. | 500 |

BUSINESSES IN WHICH USE OF ELECTRIC TRUCK HAS INCREASED PARTICULARLY

| Business | Number of Companies | Number of Trucks |
|---|---|---|
| Bakeries | 6 | 131 |
| Breweries | 6 | 33 |
| Central station | 1 | 164 |
| Coal and Ice | 3 | 40 |
| Ice cream and dairy | 16 | 136 |
| Department stores | 7 | 448 |
| Civic bureaus | 2 | 5 |
| Express and transportation | 4 | 91 |
| Furniture dealers | 2 | 4 |
| Grocers, confectioners | 6 | 152 |
| Laundries | 11 | 31 |
| Restaurants, caterers | 6 | 15 |

NUMBER OF ELECTRIC VEHICLES; AVERAGE ENERGY CONSUMPTION, REVENUE AND MISCELLANEOUS DATA

| | |
|---|---|
| Number of electric street trucks | 1,450 |
| Number of electric passenger cars | 2,500 |
| Number of electric industrial trucks and tractors | 450 |
| Total electric vehicles | 4,400 |
| Average daily energy consumption, per vehicle (kw.-hr.): | |
| Street electric trucks | 30 |
| Passenger electric cars | 10 |
| Industrial truck and tractor | 10 |
| Approximate number of days vehicles are used, estimated | 275 |
| Percentage of total on Commonwealth Edison Company's service | 90 |
| Average cost per kw.-hr. (cents) | 2½ |
| Revenue: | |
| Street trucks | $239,250 |
| Passenger cars | 137,500 |
| Industrial trucks and tractors | 24,750 |
| Total annual revenue | $401,500 |

characteristics so that every truck sold upon its recommendation represents a truck well placed. Every repeat order is economy proved and satisfaction obtained. The accompanying table is indicative of the diversified lines of business in which the electric vehicle is multiplying because of its economy. This table is not necessarily correct to date, because the past few weeks have shown considerable activity in the purchase of "electrics." One rather significant fact in connection with Chicago's electric truck fleet is that the lighter class of deliveries—those of ice-cream makers, bakeries, laundries, etc.—have made especially rapid headway during the last year. For example, one year ago there were thirty-four trucks delivering ice-cream or milk for seven dealers. Today there are 136 trucks owned by sixteen dairy and ice-cream concerns. Within the last few weeks fifty additional trucks have been ordered, one order for twenty-five being placed by a company already owning thirty-five trucks. Laundries have also increased the number of trucks employed for their deliveries, the majority of laundries appearing to find the ½-ton and 7,500-lb. (3,400-kg.) trucks best adapted to their needs. Eighteen months ago three laundries were operating five trucks. Today eleven laundries own thirty-one trucks.

CONVENIENT CHARGING STATIONS AID IN DEVELOPING ELECTRIC VEHICLE BUSINESS

Bakeries consitute another class of large user of light trucks, there being more than six bakeries with 131 trucks in actual use at the present time. The Schulz Baking Company, already owning forty-one trucks, has placed an order within the last few weeks for another fifty-eight. Even with these pleasing results, less than 10 per cent of the Chicago bakeries that could operate electric trucks to advantage have adopted them.

Ice delivery also offers the electric truck a good field of work. The energy rate is minimum as the majority of the trucks are charged through the same meter as that which measures the energy for ice making.

## GARAGE SERVICE FEATURE OF TRUCK DEVELOPMENT

The Commonwealth Edison Company has maintained a garage service for owners of electric trucks for about three years. The original purpose of this service was to relieve the truck owner of the responsibility of maintaining his trucks and charging the battery. The company has three large garages, one at Lake View, one at Garfield Boulevard and Lowe Avenue and one at Morgan and Adams Streets. The first two of these are used mostly for Commonwealth Edison Trucks. The latter was built expressly to serve truck owners and to encourage the use of electric vehicles.

This garage has proved so successful and the number of trucks now in use on the west side has increased

so rapidly that there is a waiting list of almost 100 trucks that cannot now be accommodated on account of lack of garage space. Originally intended for about 160 trucks, the garage is actually housing 200. There are 128 charging plugs, which means that 128 vehicles may be charged at one time. This corresponds to a load of about 850 kw.

For its garage service the Commonwealth Edison Company charges a fixed sum for garage and a fixed sum per kilowatt-hour furnished the truck during the month. The garage service comprises housing, washing, oiling and inspection and is charged for at the rate of 25 cents per square foot of space occupied per truck. The energy rate is 5 cents per kilowatt-hour. Repairs and insurance are not included in the garage charge.

Transportation costs for the different lines of business have been quite closely determined by the Commonwealth Edison Company. The average kilowatt-hours per day or month are known very closely. Therefore soliciting custom on the basis of purchased garage service is simply a matter of definitely stating the monthly cost. This ability to predetermine the economy of the electric truck has been an immense help in increasing the electric fleet. Another benefit of garage service is that truck owners are relieved of all responsibility in the maintenance of their trucks; they can buy maintenance service for lower cost and of better quality than they could themselves obtain.

### CHARGING FACILITIES ARE WELL DISTRIBUTED

A generous distribution of battery-charging stations has helped the growth of Chicago's electric fleet. There are at present thirty-seven charging stations scattered advantageously about the city, the number and location keeping pace with the increase in electric vehicles. Twelve out of the thirty-seven are maintained by the Commonwealth Edison Company at its various substations and garages, the remaining twenty-eight being at public garages. The number of charging stations compares fairly well with the fifty-four stations existing in New York City, including the Bronx. Daytime charging is an infinitesimal part of the total charging load. In the main, day-time charging is employed because a truck is standing idle while being loaded and unloaded or because the driver is eating his lunch. The charge is, therefore, merely a booster charge of about one-half hour's duration which occurs while the drop in load exists on the central-station system.

Chicago's central-station company has never adopted any form of battery rental such as has been found a great incentive to the use of the electric vehicle in Hartford, Conn., and several Eastern cities. Individual truck owners may, however, rent batteries from a company maintaining this form of service. At the present time one battery company is renting batteries for 220 commercial trucks and 800 passenger cars. In the majority of cases the truck owner renting batteries has only one or two trucks, although in one case a fleet of fourteen trucks is involved.

The electric vehicle situation in Chicago at the present time is such that the central station and truck manufacturers by close co-operation have developed a fleet of trucks, tractors and passenger cars that are proving the economies claimed for them. Generous charging facilities, the prospect of sufficient garage facilities, close harmony between the various interests concerned and satisfied users all combine to encourage the much wider use of electric vehicles from now on.

# Unprofitable Rural Business

## Avoiding Extensions that Will Not Produce Revenue —Irrigation Business Points the Way—Mistakes in Handling This Business

THE irrigation rate schedules in use on the Pacific Coast are worthy of consideration in the rural rate problem of the East and Middle West, particularly in their provisions guarding against unprofitable business. The rates cannot in general be applied directly to the rural service of the sections east of the Rocky Mountains and particularly not to the problem in the sections east of the Missouri River, where no irrigation of any character exists. This is because the consumption of one irrigation customer may equal the consumption of several consumers such as may be found on the rural lines of the Eastern and Middle Western companies. The service feature will therefore be much more prominent in the Eastern rural business rate than it is in the irrigation rate.

There are a number of factors in the two classes of business that are common, as follows:

1. Distribution to the consumers is scattered over large areas.

2. Loads are light and investment per customer is high as compared with the ordinary run of city or town business.

3. Operating and maintenance problems are intensified by the long distances that must be covered in reading meters, correcting service troubles and handling routine maintenance.

4. Unlike the larger portion of city business, the irrigation business, especially at the inception of a new project, offers only a small ratio between cost of construction and annual revenue. It is usually a struggle to produce enough revenue from a new project to insure the payment of the operating and fixed charges, and in the past many extensions that have been made on what was considered a sufficient basis of revenue have proved losing ventures.

5. The future growth of the business is at a slow rate, and the expenditure of money that must wait for the addition of business before it can earn a return must be undertaken with extreme caution. At the same time extensions must be made in such a manner that future growth can be handled without unnecessary scrapping of investment.

The accompanying table gives a comparative statement of the main features of a few of the Pacific Coast irrigation schedules. The item of primary importance to the manager interested in rural service is the requirement as to ratio between investment and yearly revenue. In every case there is a definite return in the way of yearly revenue specified in the schedules. The consumer in most cases can advance enough money to keep the company investment to this ratio. Refunds on various bases are made, but in general these refunds are not made until there is a growth in business that will produce a revenue on the investment represented by the refund to the original consumer. This is necessary to protect the company against the assumption of an investment on which no return can be secured. One of the early errors on many of the extensions was the making of an agreement with the consumer for refunds of money advanced, on the assumption that immediate future growth of the business would care for the company investment. The almost unanimous experience

was that the growth was not realized and the company was the loser, the loss in many cases having to be made up by other classes of service. The same mistake has been made in many Middle Western projects, either directly by the refund of money advanced for construction purposes or by requiring the consumer to purchase company securities on which the regular rates of return are paid without making certain that the revenue from the business was on a proper basis.

The return on the investment must be included in the rate unless the consumer advances the money and carries his own interest, as in the case of the plan in use among a number of Wisconsin companies. (ELECTRICAL WORLD, Dec. 18, 1920, page 1205.) The provision of a proper ratio between the cost of an extension and the yearly revenue that it must produce is a rather difficult problem and may vary in different localities. The ratio in the cases under study will be found to vary from three to one to one to one. There is an open question as to whether there is any variation in costs that would account for this large variation of the ratio. This points to the necessity for careful study of the costs of service to determine what ratio is necessary to give an adequate return on the investment after all operating expenses are paid, or, stated in another way, how many kilowatt-hours must be sold at a given profit per kilowatt-hour to pay the fixed charges. It is doubtful whether this method of protection can be employed on the problem in the Middle and Eastern States because of the very small volume of energy sold, but its use indicates one method that can be profitably studied as it is not at all impossible that the development of the rural business may provide greater demands for energy due to the development of apparatus for use on the farm and the education of the farmer to a wider use of power in his work.

Another interesting feature of the irrigation situation is that, with fully as much pressure for service and as much chance for the development of rural utilities, there has been no tendency toward the formation of such bodies. Some companies require the consumers to own and maintain all taps from the main line to their premises that are on the consumers' property. Some companies have also required the consumers to own their own transformer equipment. This practice in some cases has been abandoned because the presence of a large body of equipment on the system owned by private individuals has been found embarrassing in handling maintenance and the changing service conditions that are normal on any system.

The principal mistakes in the irrigation field in past years have been due to overenthusiasm in the viewpoint of central-station men as to the rapidity of growth of the business and to failure to consider fully enough the effect on a system of business that gave a load on the system of only six months or less. Part of the lack of consideration has been due to the pressure from the community for a service that was and is vital, because in most of the western sections of the country agricultural pursuits are impossible without irrigation. While pressure for the same reason is not felt in the states farther east, it seems apparent from developments of the past two or three years that pressure just as insistent is developing. The danger of overenthusiasm in the problem of the Middle West and East is probably not so great as in the earlier irrigation problems, since financial stringency and the absorption of facilities by war conditions have combined to retard the taking of the offered business. This condition, however, brings a tendency in many quarters to ignore the problem entirely as of too little consequence in comparison with other demands made on the central station. With the pressure for rural service growing greater, there is danger in the ignoring of the problem too long and a possibility of the repetition of the mistakes made in the irrigation field under the demands of the public for service. The safeguards that have been thrown about the irrigation schedules to guard against unwise investment are those developed from rather unpleasant experience, and while they may not be followed in form in the present rural problem, they must be repeated in substance.

RURAL CUSTOMER REQUIREMENTS THAT SAFEGUARD INVESTMENTS AND WEED OUT UNDESIRABLE BUSINESS

| Co. No. | Ratio Yearly Revenue to Cost | Policy Where Ratio Is Less than Required | Effect on Rates if Customer Makes Advance |
|---|---|---|---|
| 1 | One to one..... | Customer advances enough to make required ratio..... | Refund of one-third of monthly bills for period of five years; depend on judgment, to avoid extensions that will not make adequate return if customer advances part cost..... |
| 2 | Revenue 75 per cent of cost..... | Customer advances enough to make required ratio..... | None |
| 3 | Revenue one-third of cost..... | Where less than 337 per cent and more than 20 per cent customer may (*a*) advance cost of extension, (*b*) construct enough of extension to bring revenue to 337 per cent, or (*c*) guarantee 337 per cent revenue..... | Where customer advances cost, refund is made at rate of 20 per cent of monthly bills. If new business is connected, immediate refund of such portion as is justified is made, or if revenue is guaranteed the guarantee is reduced. |
| 4 | One to one..... | Customer may advance part of cost or build part of extension.... | Refund made as increased business connected warrants. |
| 5 | Fixed ratio varied to meet financial and power conditions on system... | Customer may advance cost of extension..... | Refund at rate of 20 per cent of monthly bills. |
| 6 | Revenue one-third of cost..... | Customer may advance part of cost..... | Refund when revenue from line warrants. |
| 7 | Revenue must pay operating expense, interest, depreciation at 10 per cent and 8 per cent on investment..... | Customer may advance part of cost..... | Refund when revenue from line warrants. |

ADDITIONAL PROVISIONS

**Company No. 1**—Company has two schedules, one providing a low kilowatt-hour rate, in addition to fixed charge, and guaranteeing maximum cost per horsepower for irrigation season. Alternate provides kilowatt-hour rate only, with maximum cost guarantee. Customer guarantees minimum revenue per horsepower.

**Company No. 2**—Five-year contract backed by cash deposit or lien on land.

**Company No. 5**—Customer required to furnish own tap lines on own property. No refund on this cost.

**Company No. 7**—Customer must own distribution laterals from point of delivery. Applies where consumer has several points of utilization, such as a common irrigation situation.

## High-Power Radio Station for Switzerland

BY SEPTEMBER next the Marconi Radio Station, Ltd., of Switzerland must have a high-power radio station installed and in service near Muenchenbuchsee, in the Canton of Berne, according to the Swiss General Telegraph Bureau, which has now submitted a report including the following details, which are to be embodied in the contract: The station must have a sending range of 2,000 m. at least, which means a so-called continental station. The duration of the concession will be for twenty-five years. Only Swiss will be employed, and all equipment and material required must be purchased of Swiss manufacturers. According to the proposed contract, the federal government may at any time, if the security and order of the country should demand it, seize the station.

# Use of Several Conductors in One Conduit Reduces Current Capacity

## Formula Suggested to Calculate Current per Conductor for Any Number of Conductors per Conduit — Test Basis of Tables for Various Sizes and Numbers of Conductors per Conduit—Tables Showing Reduction of Current-Carrying Capacity

By HENRY C. HORSTMANN* and VICTOR H. TOUSLEY†

TESTS relative to the heating of conductors in conduit pipe were conducted in 1918‡ the results of which were published in installments in the ELECTRICAL WORLD shortly thereafter. All the tests were made with three conductors in the same pipe, all three carrying the same current. While the results so obtained fit the severest working conditions to which a three-phase system can be subjected, they will be more or less erroneous when applied to four-wire, two-phase systems, to three-wire systems provided with neutral wire carrying normally no current, and to the regular two-wire systems, as well as to wires run in parallel. The latter case especially requires attention.

It is well known that the carrying capacity per circular mil given by the National Electrical Code is much greater for small wires than for the larger ones, there being actually a ratio of about six to one between the carrying capacity of a No. 14 wire and that of a 1,000,000-circ.mil cable. In this fact lies a great temptation for the economically inclined to save copper by running two smaller wires in parallel instead of a larger one of the same capacity. The tables, for instance, allow six 400,000-circ.mil cables to carry the same current in the same conduit required for three 1,000,000-circ.mil cables. This is an increase of 20 per cent in resistance without any change in other conditions, hence considerable added heating must result.

Obviously, it would be too tedious and expensive to carry out a complete set of tests of several hundred combinations of wire similar to those described before, and it was thought that such complete tests would not be necessary if the following theoretical considerations should prove approximately true. It is a reasonable assumption that the temperature rise in any number of conductors contained within a given conduit pipe is proportional to the watts lost in the conductors, the watts lost representing the energy transformed into heat. If this assumption proves correct, it will be possible to determine the permissible amperage of any number of conductors in conduit by the formula $I = \sqrt{W/rn}$, in which $W$ stands for the watts lost in one set of conductors, $r$ is the resistance of one of the conductors in question and $n$ the number of wires considered.

In order to ascertain the correctness of these assumptions, tests were made by the Commonwealth Edison Company, comparing the heating caused in fifty-seven No. 14 conductors each carrying 7.38 amp. with that in three No. 4/0 cables each carrying 225 amp. It was calculated that the watts lost in both cases would be the same and the temperature rises should therefore be about equal. A test was also made comparing the heating effect of three No. 4/0 conductors, one of which was carrying no current, with three conductors of the same size all of which were carrying current. The results are given in Fig. 1 by the three curves A, B, and C. Theoretically the curves A and B should be identical and C should have risen to D. But, as we shall see further on, there are many factors not thoroughly known which make accuracy impossible. It is thought, however, that the results are close enough to warrant the use of the formula first suggested, at least until something better is known.

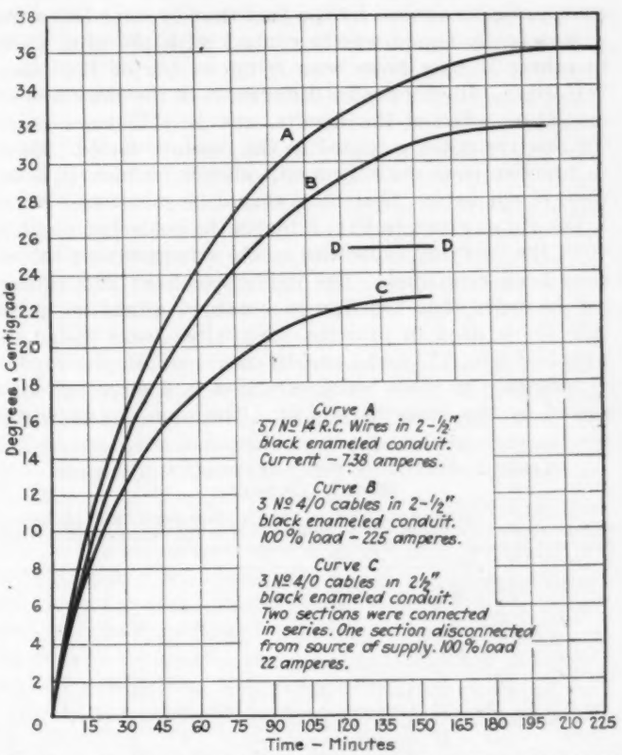

Degrees, Centigrade
Time – Minutes
A
B
C
D — D
Curve A
57 No 14 R.C. Wires in 2-½" black enameled conduit. Current – 7.38 amperes.
Curve B
3 No 4/0 cables in 2-½" black enameled conduit. 100% load – 225 amperes.
Curve C
3 No 4/0 cables in 2½" black enameled conduit. Two sections were connected in series. One section disconnected from source of supply. 100% load 22 amperes.

FIG. 1—ACTUAL HEATING OF RUBBER-COVERED WIRE AND CABLE IN CONDUIT

Theoretically *A* and *B* should coincide, while *C* should rise to *D-D*

In determining the carrying capacity of combinations of wires not actually tested it was thought best, first of all, to fix upon the heat-dissipating power of the different sizes of conduit. In order to do this the carrying capacities which it was estimated would bring all conductors to the same temperature were used as a basis to compute the wattage dissipated in the various sizes of conduit. To show the distinction, the National Elec-

*Department of Gas and Electricity, Chicago.
†Chief electrical inspector Department of Gas and Electricity, Chicago.
‡Conducted by the Commonwealth Edison Company at the request of the Department of Gas and Electricity of Chicago.

trical Code current recommendations are given in columns at the left and the estimated carrying capacities in adjoining columns of Tables I and II.

The method used to determine finally the wattage-dissipating capacity of the different sizes of conduit is explained by Fig. 2. At the bottom are the conduit sizes, each below a certain line. In the same vertical line are the various sizes of wire tested in pipe of that size. The height of the points measured from the base indicates the wattage that was dissipated in a given conduit by a given size of wire. It will be noted that there is a considerable variation. The wattage dissipation corresponded in each case with a temperature rise of 32 Fahr. (20 C.) in the conductors. The variations were probably caused by the fact that in some cases the wire actually tested was in contact with the pipe while in others it may have been lying on top of the other two wires. In other cases differences in the thickness of insulation affected the results, and in still more cases the relative space occupied in the conduit varied. Since in practice such variations will always be met, it is as well, if not better, that they should be mentioned here.

The curve given in Fig. 2 forms the basis from which all of the carrying capacities in the accompanying tables have been computed. The curve has been run rather low in order that the figures obtained might be quite safe to be used in practice. No wires were tested in 5-in. and 6-in. (12.5-cm. and 15-cm.) conduit, the curves in reference to them being extended in a direction suggested by the lower part of it. The numbers of wires given in the tables as permissible in the various sizes of conduit are calculated to occupy about 40 per cent of the space in the conduit.

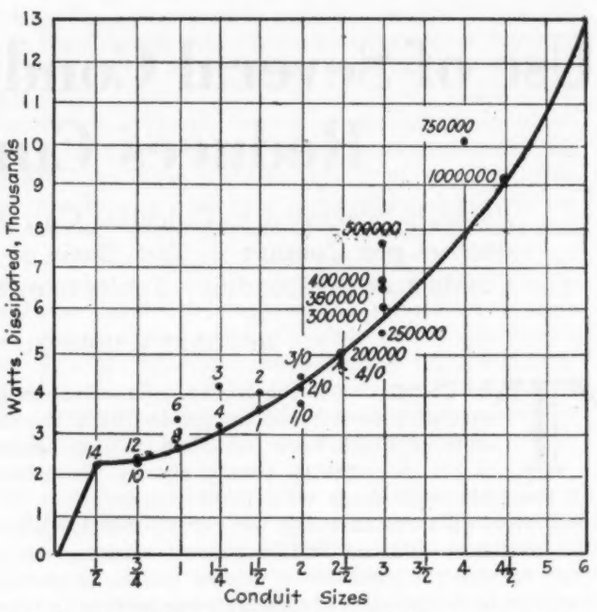



FIG. 2—WATTAGE-DISSIPATING CAPACITY OF VARIOUS SIZES OF CONDUIT

The curve drawn as an average through the points is basis of the carrying capacity given in Tables I and II.

TABLE I—EFFECT OF USING SEVERAL CONDUCTORS IN ONE CONDUIT

Comparison of estimated and National Electrical Code current-carrying capacities per conductor for from one to six conductors in the same conduit. Wires calculated to occupy about 40 per cent of space in conduit.

| B. & S. Gage | N.E. Code Carrying Cap. (Amp.) | Estimated Carrying Cap. (Amp.) | | Number of Wires 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|
| 14 | 15 | 17 | Conduit | ½ | ½ | ½ | ¾ | ¾ | ¾ |
| | | | Amp. | 29 | 20 | 17 | 14 | 13 | 12 |
| 12 | 20 | 22 | Conduit | ½ | ¾ | ¾ | ¾ | ¾ | 1 |
| | | | Amp. | 37 | 27 | 24 | 19 | 17 | 16 |
| 10 | 25 | 27 | Conduit | ½ | ¾ | ¾ | 1 | 1 | 1 |
| | | | Amp. | 47 | 34 | 28 | 25 | 22 | 20 |
| 8 | 35 | 36 | Conduit | ½ | 1 | 1 | 1 | 1 | 1 |
| | | | Amp. | 58 | 44 | 36 | 31 | 28 | 26 |
| 6 | 50 | 52 | Conduit | ½ | 1 | 1¼ | 1¼ | 1¼ | 1¼ |
| | | | Amp. | 74 | 56 | 50 | 43 | 38 | 35 |
| 5 | 55 | 56 | Conduit | ¾ | 1¼ | 1¼ | 1¼ | 1¼ | 1¼ |
| | | | Amp. | 86 | 79 | 55 | 48 | 47 | 43 |
| 4 | 70 | 64 | Conduit | ¾ | 1¼ | 1¼ | 1¼ | 1¼ | 2 |
| | | | Amp. | 96 | 76 | 62 | 59 | 53 | 52 |
| 3 | 80 | 82 | Conduit | ¾ | 1¼ | 1¼ | 1¼ | 2 | 2 |
| | | | Amp. | 112 | 86 | 70 | 60 | 64 | 58 |
| 2 | 90 | 90 | Conduit | ¾ | 1¼ | 1¼ | 1½ | 2 | 2 |
| | | | Amp. | 121 | 96 | 86 | 75 | 72 | 66 |
| 1 | 100 | 96 | Conduit | ¾ | 1½ | 1½ | 2 | 2 | 2½ |
| | | | Amp. | 135 | 117 | 96 | 89 | 80 | 80 |
| 0 | 125 | 110 | Conduit | 1 | 1½ | 2 | 2 | 2½ | 2½ |
| | | | Amp. | 159 | 134 | 118 | 101 | 99 | 91 |
| 00 | 150 | 130 | Conduit | 1 | 2 | 2 | 2½ | 2½ | 3 |
| | | | Amp. | 179 | 161 | 134 | 124 | 112 | 109 |
| 000 | 175 | 150 | Conduit | 1 | 2 | 2 | 2½ | 2½ | 3 |
| | | | Amp. | 200 | 179 | 146 | 138 | 124 | 122 |
| 200,000 | 200 | 175 | Conduit | 1½ | 2 | 2½ | 2½ | 2½ | 3 |
| | | | Amp. | 237 | 197 | 176 | 152 | 138 | 134 |
| 0000 | 225 | 180 | Conduit | 1½ | 2 | 2½ | 2½ | 2½ | 3 |
| | | | Amp. | 245 | 205 | 182 | 158 | 141 | 138 |
| 250,000 | 240 | 205 | Conduit | 1½ | 2½ | 2½ | 3 | 3 | 3½ |
| | | | Amp. | 265 | 241 | 197 | 184 | 164 | 161 |
| 300,000 | 275 | 238 | Conduit | 1½ | 2½ | 2½ | 3 | 3½ | 4 |
| | | | Amp. | 288 | 263 | 214 | 200 | 194 | 188 |
| 400,000 | 325 | 290 | Cond. | 1½ | 3 | 3 | 3½ | 4 | 4 |
| | | | Amp. | 333 | 327 | 268 | 251 | 239 | 217 |
| 500,000 | 400 | 345 | Cond. | 1½ | 3 | 3 | 3½ | 4½ | 4½ |
| | | | Amp. | 405 | 363 | 297 | 277 | 288 | 265 |
| 600,000 | 450 | 390 | Cond. | 1½ | 3 | 3½ | 4 | 4½ | 5 |
| | | | Amp. | 447 | 401 | 355 | 327 | 319 | 316 |
| 700 000 | 500 | 430 | Conduit | 2 | 3½ | 3½ | 4½ | 5 | 5 |
| | | | Amp. | 517 | 468 | 379 | 382 | 371 | 339 |
| 800,000 | 550 | 465 | Conduit | 2 | 3½ | 4 | 4½ | 5 | 6 |
| | | | Amp. | 557 | 502 | 436 | 412 | 400 | 400 |
| 900,000 | 600 | 495 | Conduit | 2 | 3½ | 4 | 4½ | 5 | 6 |
| | | | Amp. | 591 | 532 | 463 | 438 | 424 | 424 |
| 1,000,000 | 650 | 525 | Conduit | 2 | 4 | 4 | 5 | 6 | 6 |
| | | | Amp. | 618 | 591 | 483 | 490 | 486 | 444 |

TABLE II—REDUCTION OF CURRENT-CARRYING CAPACITY CAUSED BY USING SEVERAL CONDUCTORS IN ONE CONDUIT

Comparison of estimated and National Electrical Code current-carrying capacities per conductor when different sizes and different numbers of conductors are used in conduit from 1 in. to 6 in. in diameter.

| B. & S. Gage | N.E. Code Carrying Cap. (Amp.) | Estimated Carrying Cap. (Amp.) | | Conduit Sizes (In.) 1 | 1¼ | 1½ | 2 | 2½ | 3 | 3½ | 4 | 4½ | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 15 | 17 | No. wires | 10 | 17 | 24 | 40 | 57 | 88 | 118 | 151 | 190 | 237 | 342 |
| | | | Amp. | 10 | 8 | 7 | 6 | 6 | 5 | 4.5 | 4 | 4 | 4 | 4 |
| 12 | 20 | 22 | No. wires | 8 | 14 | 19 | 32 | 46 | 72 | 97 | 123 | 155 | 193 | 280 |
| | | | Amp. | 14 | 11 | 10 | 9 | 8 | 7 | 6.5 | 6 | 6 | 6 | 5 |
| 10 | 25 | 27 | No. wires | ... | 11 | 15 | 25 | 36 | 55 | 85 | 96 | 120 | 150 | 216 |
| | | | Amp. | ... | 16 | 15 | 12 | 11 | 10 | 9 | 9 | 8.5 | 8 | 7.5 |
| 8 | 35 | 36 | No. wires | ... | 9 | 12 | 20 | 29 | 45 | 61 | 78 | 98 | 123 | 177 |
| | | | Amp. | ... | 22 | 21 | 18 | 16 | 14 | 13 | 12 | 12 | 11 | 10 |
| 6 | 50 | 52 | No. wires | ... | ... | ... | 9 | 13 | 21 | 28 | 36 | 45 | 56 | 81 |
| | | | Amp. | ... | ... | ... | 33 | 30 | 26 | 24 | 23 | 22 | 22 | 20 |
| 5 | 55 | 56 | No. wires | ... | ... | ... | 88 | 11 | 18 | 24 | 31 | 39 | 49 | 71 |
| | | | Amp. | ... | ... | ... | 40 | 37 | 31 | 30 | 30 | 28 | 27 | 24 |
| 4 | 70 | 64 | No. wires | ... | ... | ... | 7 | 10 | 16 | 21 | 27 | 34 | 43 | 62 |
| | | | Amp. | ... | ... | ... | 48 | 43 | 37 | 35 | 33 | 32 | 31 | 28 |
| 3 | 80 | 82 | No. wires | ... | ... | ... | ... | 9 | 14 | 19 | 24 | 31 | 38 | 56 |
| | | | Amp. | ... | ... | ... | ... | 52 | 45 | 42 | 39 | 38 | 37 | 33 |
| 2 | 90 | 90 | No. wires | ... | ... | ... | ... | 8 | 13 | 17 | 22 | 28 | 35 | 50 |
| | | | Amp. | ... | ... | ... | ... | 62 | 52 | 49 | 46 | 45 | 43 | 40 |
| 1 | 100 | 96 | No. wires | ... | ... | ... | ... | ... | 10 | 13 | 17 | 21 | 27 | 39 |
| | | | Amp. | ... | ... | ... | ... | ... | 67 | 63 | 59 | 58 | 55 | 51 |
| 0 | 125 | 110 | No. wires | ... | ... | ... | ... | ... | 8 | 11 | 15 | 19 | 23 | 34 |
| | | | Amp. | ... | ... | ... | ... | ... | 84 | 78 | 71 | 69 | 67 | 61 |
| 00 | 150 | 130 | No. wires | ... | ... | ... | ... | ... | 7 | 10 | 13 | 16 | 20 | 29 |
| | | | Amp. | ... | ... | ... | ... | ... | 101 | 91 | 85 | 84 | 81 | 75 |
| 000 | 175 | 150 | No. wires | ... | ... | ... | ... | ... | ... | 8 | 11 | 14 | 17 | 25 |
| | | | Amp. | ... | ... | ... | ... | ... | ... | 114 | 103 | 101 | 99 | 90 |
| 200,000 | 200 | 175 | No. wires | ... | ... | ... | ... | ... | ... | 7 | 9 | 12 | 15 | 21 |
| | | | Amp. | ... | ... | ... | ... | ... | ... | 134 | 126 | 118 | 114 | 107 |
| 0000 | 225 | 180 | No. wires | ... | ... | ... | ... | ... | ... | 7 | 9 | 12 | 15 | 21 |
| | | | Amp. | ... | ... | ... | ... | ... | ... | 138 | 130 | 122 | 118 | 110 |
| 250,000 | 240 | 205 | No. wires | ... | ... | ... | ... | ... | ... | ... | 8 | 10 | 12 | 18 |
| | | | Amp. | ... | ... | ... | ... | ... | ... | ... | 149 | 145 | 143 | 130 |
| 300,000 | 275 | 238 | No. wires | ... | ... | ... | ... | ... | ... | ... | ... | 8 | 10 | 15 |
| | | | Amp. | ... | ... | ... | ... | ... | ... | ... | ... | 179 | 173 | 155 |
| 400,000 | 325 | 290 | No. wires | ... | ... | ... | ... | ... | ... | ... | ... | 7 | 8 | 12 |
| | | | Amp. | ... | ... | ... | ... | ... | ... | ... | ... | 219 | 221 | 203 |
| 500,000 | 400 | 345 | No. wires | ... | ... | ... | ... | ... | ... | ... | ... | ... | 7 | 10 |
| | | | Amp. | ... | ... | ... | ... | ... | ... | ... | ... | ... | 265 | 243 |
| 600,000 | 450 | 390 | No. wires | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 9 |
| | | | Amp. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 285 |
| 700,000 | 500 | 430 | No. wires | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 8 |
| | | | Amp. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 321 |
| 800,000 | 550 | 465 | No. wires | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 7 |
| | | | Amp. | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | 370 |

# Regulations Governing Development of Water Power in Japan*

## Methods of Making Applications—Features of Concessions—Limitations Imposed—State Governors Have Power to Alter Designs and Rescind Concessions—Basis of Calculations Required—Electric Companies Have Right of Eminent Domain

WITH the federal water-power act "on trial," so to speak, in this country, water-power regulations in other nations assume a special interest. Since Japan has had an imperial water-power law in effect for many years now the general procedure in that country will be related. This information is not presented as serving to indicate the regulation or procedure that should exist in this country, although the regulations of the Japanese government have numerous merits, such as giving hydro-electric companies the right of eminent domain and discouraging illegitimate promotion schemes by the completeness of information required in the application and the limitations set on time of starting and completing developments. Another interesting feature of the Japanese regulations is that they tend to amass a central compilation of data on drainage areas, stream flows, geology, rainfall and estimated construction costs that, if properly checked and verified, should be helpful in future developments.

While an electric company in Japan has almost unlimited privileges in connection with the properties of others, unfair or unnecessary occupation of private property is held in check by the damages which are assessed against electric companies for such aggression. Probably the greatest single deterrent to water-power development in the Island Empire, however, is the wide scope of authority given the state or ken governor in altering designs and rescinding concessions.

In the past, however, no abuse of this power has been experienced by the holders of water-power concessions and it is possible that this feature of the law may be modified in the near future.

Aside from what bearing they may have on our own water-power problems, the following regulations and requirements should be particularly helpful to engineers or organizations interested in securing Japanese water-power concessions.

In Japan the ownership of all water-power is vested in the imperial government. A development may be made only after a license or concession has been secured from the government. In granting such a concession the government always reserves the right to rescind it at the expiration of the initial term or at any time, if it should be considered necessary to do so in the interest of the public. Any group of individuals may make application for the use of undeveloped water-power. In case two or more applications are filed for the same power site, the government in granting concessions takes into consideration the priority of application, the purpose for which the power is to be used and also the general ability of the applicant to construct and maintain a satisfactory development.

In applying for water-power privileges two separate documents must be prepared—one for the Department of Communications—the other for the Home Department. The two applications contain substantially the same general information, but the Department of Communications requires more detailed information regarding the commercial features of the enterprise. The Home Department is more concerned with the features of construction and the methods used to determine the effect of these structures on flood control, irrigation and other interests of the people.

Applications for water-power privileges must be filed with the governor of the ken or state in which the water-power is located. Negotiations must then be carried on with the public officials in the immediate vicinity of the power site and with the governor of the state. Such negotiations include procuring agreements with the local people concerning the various community interests, such as logging, fishing, irrigation, navigation and the customary use of hot springs along the river for pleasure or health resorts. It is, however, unnecessary to purchase any riparian rights, as the required property can be acquired after the concession is obtained either by direct purchase or by virtue of the right of eminent domain conferred with the concession.

When tentative agreements have been reached regarding all the various local interests, and when the state authorities have given consent to the project, the governor signs the application and forwards it to the central government. If the ministers of the Department of Communications and the Home Department approve the application, a concession is then granted in accordance with the usual terms. Ordinarily two years or more are required to complete all these negotiations and satisfy the requirements of all concerned.

The application to the Department of Communications should be accompanied by a letter of transmittal addressed to the governor of the state in which the river is situated. The letter should request permission to use the water power and should contain a very brief description of the proposed development. It should also state the purpose for which the power is to be used. The letter should be dated and signed by all the promoters of the enterprise. A typical form of application to the Department of Communications follows:

I.—General statement, including:

1. Names of the promoters with their addresses, titles, ranks and business affiliations.

2. Proposed use of the water power and the length of time requested.

*This article has been compiled from information and data furnished by Charles B. Hawley, Consulting Engineer, Washington, D. C., who has had occasion to investigate all water powers of any size in Japan. Mr. Hawley has had exceptional opportunities to study regulations governing water-power development in Japan in connection with the preparation and negotiation of several applications to the imperial government for water power concessions.

3. District in which the power will be used.

4. Total power developed, in kilowatts.

II.—General description of the water-power development, including:

1. Name of the river and location of the various construction features, such as dam, power house, etc.

2. Statement giving the quantity of water to be used and explaining in a general way the conditions which have a bearing on the utilization of water for power purposes. This statement will discuss the amount of water, if any, required for navigation, logging, irrigation and fisheries.

3. Effective head at the waterwheels (with computation sheets).

4. Theoretical horsepower developed (with computation sheets).

5. Map showing the general plan of development.

6. Topographical maps prepared from preliminary surveys.

7. General explanation of the construction works. This will require:

(a) General statement of the entire scheme of development.

(b) Detailed description of the dam.

(c) Detailed description of the intake.

(d) Detailed description of the conduit (with computation sheets showing the loss of head in the conduit).

(e) Detailed description of the surge tank, if any.

(f) Detailed description of the penstocks.

(g) Detailed description of the power house and tailrace. This statement will also list the principal equipment in the power house.

III.—Statement regarding the hydrology of the river, giving:

1. Drainage area with maps and computations by which it has been figured.

2. Statement of the character of the drainage area, giving, in percentages of the whole, forested areas, cleared areas and improved lands. Other features of the drainage area should be discussed, such as the general topography and the geology. It is also necessary to state what crops are raised on the improved lands.

3. Rainfall of the district with tables giving available precipitation records.

4. Statement of what stream gagings have been made on the river; a résumé of stream-flow records, including the maximum flood of record, the normal yearly flood, the average annual run-off, the minimum daily stream flow, the minimum ten-day flow and the minimum sixty-day stream flow.

5. If the gaging station on this river is not in the immediate vicinity of the proposed water-power development, the stream-flow records given in item 4 should be corrected for difference in the drainage areas at the gaging station and the intake of the development.

6. Geology of the section of the river to be developed with a complete description of the dam site and the power-house site.

IV.—Estimated cost of the development. [This will include all rainfall and stream-flow records available, as well as the computation sheets used in determining the size of the tunnel, the effective head on the turbines, the theoretical horsepower developed, depth of water on the crest of the dam during flood and the flood back-water curve above the dam.—ED.]

## FEATURES OF TYPICAL CONCESSIONS

Certain features of the water-power concessions granted by the Japanese government are peculiar as well as interesting and are given below:

V.—Grantees shall file all applications for permission to start actual construction work within six months from the day following the granting of this concession. The applications shall be filed with the governor. [Instructions regarding scale of drawings, changing design, precautions to prevent erosion and slides, fish ladders, etc., follow in actual concession.—ED.]

VI.—Whenever a change in the design is essential for the protection of the public interest the Governor may order such alterations to be made. [Articles XI, XII, XIII, XVIII and XXIV give more specific applications of this principle.—ED.]

VII.—The grantees shall start actual construction work within one month after obtaining the grant as set forth in Article V hereof and shall complete construction work within two years after beginning work.

1 and 2. Should the grantees be unable to start actual construction work in the prescribed period or to complete the same within the allotted time owing to causes beyond their control, the grantees may file an application for an extension of time. Such application for an extension of time shall be filed not later than one month after the occurrence causing the delay and shall not exceed one year.

3. In case the designs are altered by the order of the governor, an application for an extension of time may be filed.

4. The foregoing applications in each and every case shall be filed not later than one month after the date on which the order of such changes has been received from the governor.

5. Immediate report shall be made to the governor of the actual beginning of construction work.

VIII.—[Refers to securing permission where development involves forest reserve, national forest or areas under government supervision.—ED.]

IX.—Whenever it becomes necessary to change the course of riverbeds, roads, bridges, hydraulic works or other construction works already in existence, the grantees before starting any construction shall first negotiate with the parties owning or connected with such works and obtain their permission for such changes. The grantees shall further report such negotiations to the governor and obtain his approval thereof.

X.—Whenever there is any possibility of injuring or damaging any irrigation or other hydraulic works or interfering with the fishing interests because of the contemplated construction works, the grantees shall before starting such construction works negotiate with the owners thereof and shall take such measures for the protection of such interests as are necessary and shall also report the procedure and conclusions of such negotiations to the governor and obtain his approval thereof.

XI, XII and XIII.—Whenever there will be injury or damage done to the natural scenery by the construction of said works, the governor may order the grantees to plant trees or take such measures as are necessary to remedy such defects. [He has similar powers in regard to the protection of river improvements, etc.—ED.]

XIV.—The grantees are not permitted to object to any orders of the governor issued for changes or improvements that are required for the public welfare, even though such changes may cause delay in the construction work and may require changes in the designs and method of construction.

XV. and XVI [Provide for reporting completion of plant and starting operation.—ED.]

XVII.—The addition of new promoters or the withdrawing of any promoter from the organization shall be reported to the governor, and such changes shall be subject to his approval. In like manner, any change in the representative of the organization shall be reported to the governor immediately.

XVIII.—Whenever the public interests require, the governor may order that the diversion of water from the river be stopped or otherwise limited for such period of time as is necessary for the interests of the public.

XIX.—The governor will make inspection of the entire hydraulic works, their accessories and river revetments, and when he deems it necessary may order the grantees to do additional construction work and to make necessary changes.

XX.—The grantees, upon receiving this concession, shall make reports in accordance with the regulations governing the uses of electricity for private purposes and shall make stream flow gagings, keeping tabular and graphic records of gage heights and actual stream flow, copies of which shall be forwarded to the governor's office. Stream-flow records shall be kept in conformity with the above instructions even before actual construction work is started.

XXI.—The governor may revoke this grant either in

whole or in part under the following circumstances and may, moreover, order that construction work be entirely suspended or changed:

1. If in his opinion the public interest requires such action.

2. If the grantee has not complied with all of the conditions of this grant, or with the law, or with the orders issued under the terms of this grant.

3. If he deems such action necessary on account of the condition of the river or for other causes which have transpired after the granting of this concession.

XXII.—This concession shall become null and void under the following conditions:

1. If an application is not filed for permission to carry on the construction of works to develop electric power for private use, or when such application is not approved, or when the approval of such an application is later revoked. 2. If an application is not filed in accordance with Article V hereof, or if such application is not filed within the prescribed time limit, or when such application has not been approved. 3. If construction work is not started within the time prescribed in paragraph 1, Article VII, or when the construction work has not been completed within the stipulated time.

4. If construction work is abandoned before completion.

5. If business is discontinued.

6. If the complete organization is dissolved.

7. If the corporate life of the organization has expired.

8. Upon expiration of this grant.

9. Upon failure of the company to organize properly after filing an application as set forth in Article V hereof.

10. Upon failure of the company after its due incorporation to carry out its business operations in conformity with the conditions in this concession.

XXIII and XXIV.—[Upon the expiration or cancellation of this concession, the governor may order the grantees to remove all construction and equipment, either in whole or in part, and to restore the power site to its original condition, provided that the governor may not confiscate or take over as government property the whole or any part of the construction work already made. He may change or add to these instructions.—ED.]

XXV.—The governor may himself execute this work [alterations] or order others to execute this work when, in his opinion, the grantees have failed to comply with the conditions of this concession, or if it appears that the construction work is not being properly carried out. If the governor deems an emergency exists, he may himself execute the orders which he has given the grantees in accordance with the provisions of Articles XII, XIII and XIX, or he may order a third party to execute his orders. XXVI.—The grantees shall be required to pay all expenses incurred in the execution of the orders issued in compliance with the conditions of this concession, even if such expenses result in losses to the grantees. Such losses shall be borne by the grantees, who shall not claim any indemnity. XXVII.—No rights accruing under this concession or responsibility imposed by it may be transferred or loaned to others unless permission is obtained for such transfer under the following conditions:

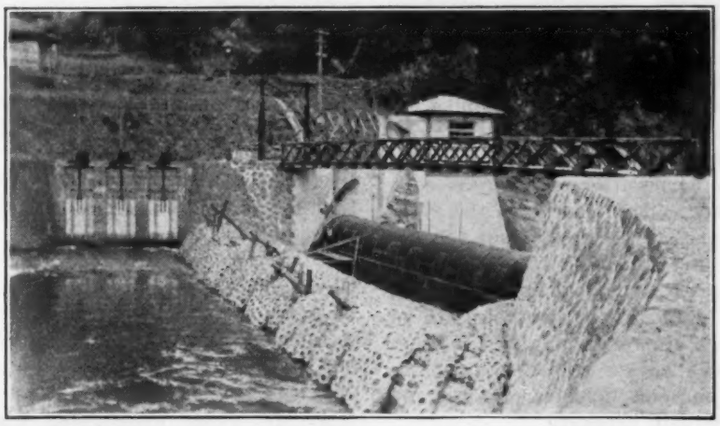
1. If the construction work is completed.

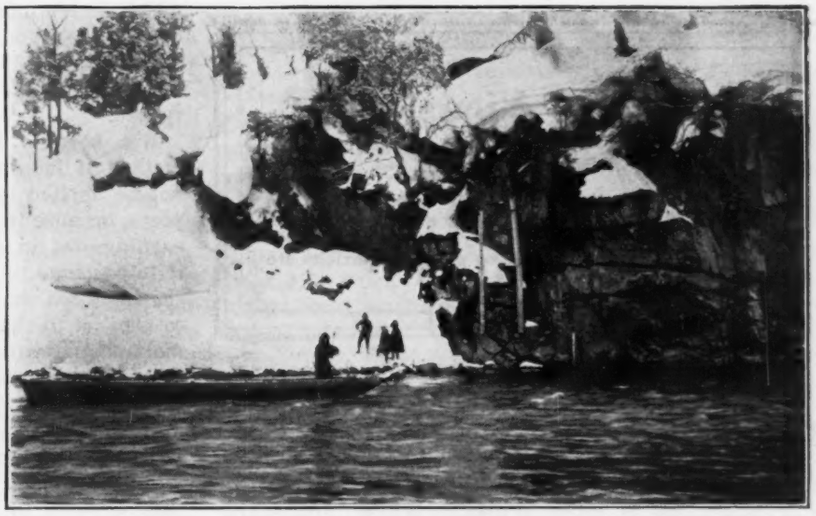
2. When considerable progress has been made in the work.

3. When two or more companies are amalgamated.

4. The period of this concession may not be shortened or prolonged because of any change in the organization of the company or because any transfer of its rights or responsibilities is provided for in the foregoing.

XXVIII.—Each and all of the grantees are held responsible for compliance with the conditions of this concession.





**WATER-POWER DEVELOPMENTS IN JAPAN HAVE BEEN UNDER GOVERNMENT REGULATION FOR SEVERAL YEARS**

Top—Rolling dam near Suruga, Japan, under repair. The repair work was carried on in January, 1918, when it was possible to divert the entire stream flow through the intake and use it for power purposes. The photographs show the Japanese type of cofferdam, which is made up of "sausage-shaped" baskets filled with stone. These rock-filled baskets are used extensively in the construction of wing dams and other works for flood control.

At left—A valuable water power in northern Japan.

At right—Stream gaging on the Miya River in northern Japan. Two low water stages ordinarily occur annually on Japanese rivers, one in January or February, the other in July or August. As a result of the very high annual precipitation in Japan, water power streams frequently yield a minimum run-off of more than 2 cu.ft. per second per square mile of catchment area.

Before construction is begun it is necessary to furnish the Bureau of Electricity of the Department of Communications with a complete description of the electrical features of the project, including the details regarding equipment to be installed. Where a plant is used to furnish power for public service purposes, 25 per cent extra generating capacity must be installed and held in reserve as a spare. This ruling may be modified in case the water-power plant is connected with a steam reserve. The Bureau of Electricity also determines what frequency shall be adopted for the proposed electric system. At present three frequencies are common in Japan, 40, 50 and 60 cycles. It is the purpose of this governmental regulation to maintain a common frequency throughout certain zones or districts.

It is also necessary to secure construction permits after much the same manner as building permits are issued in our cities. Special permission must also be received to buy and use explosives.

In Japan public service corporations as well as companies holding water-power concessions have the right of eminent domain. From a casual reading of the law conveying this right it would appear, as remarked previously, that an electric company had almost unlimited privileges in connection with the property rights of others. This is true in certain respects. On the other hand, ample damages are always assessed against the electric company, which serve as a check against unnecessary occupation of private property.

# Readers' Views and Comments

**This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited**

## Need for Information on Treatment of Electrical Burns and Shock

*To the Editor of the* ELECTRICAL WORLD:

SIR: Almost every set of instructions as to first aid for electrical injury reprints the instructions for resuscitation, as is quite proper. While information about the changes that have taken place in the method of resuscitation as we have learned more about it is widely disseminated, somehow very little instruction is given with regard to the treatment of burns—which may be quite deep and cover a large area—and insufficient instruction with regard to the treatment that should be given for shock even in cases where prostration does not result at the time.

I have in mind a number of cases where men have received flash burns which covered a rather large area and which were so painful that the proper treatment in the first place meant a great deal, and cases where shock was not suggested to those who took care of the injured men simply because the latter were not prostrated at the time and even seemed rather active, though they afterward succumbed to the shock. In one case recently a man died when he was thought to be all right, not having been prostrated at all.

Picric acid is seldom mentioned, and yet the writer believes that picric acid and prepared dry picric gauze are far better than carron oil for treatment of burns. Believing as I do that these two things should receive more consideration, it is urged that the subject be investigated and that the best-known methods should have adequate publicity.

J. M. BUSWELL,
General Inspector.

San Joaquin Light & Power Corporation,
Fresno, Cal.

## Valuation of Public Utility Properties for Rate Making

*To the Editor of the* ELECTRICAL WORLD:

SIR: In valuations of public utility properties for rate-making purposes there seems to be considerable confusion as to just what is to be arrived at. The Supreme Court says that it is "the present fair value—what a willing buyer would pay to a willing seller."

The great confusion comes in this: What a willing buyer would pay to a willing seller is based upon what that buyer and seller guess the future earnings of the plant will be, tempered by their guess as to the future cost to reproduce the plant in its present condition. Obviously no buyer would pay, in a competitive business, much more than it would cost in the near future to reproduce the plant and business. Certainly he would not pay more than the amount on which a return is probable comparable with that from other businesses of like risk. No seller would take less than the amount on which, in his judgment, the business would in the future earn. The amount invested in the business in the past, its earnings in the past, its cost to reproduce today, have no influence except as they are an indication of the future.

But here is the stumbling block. This universal method of judging value in competitive businesses cannot be applied to a public utility for rate-making purposes, because if its value is judged from its prospective earnings, as in a competitive business, we must allow it to continue to earn on that basis in order to support the valuation thus arrived at. That is, we must continue to allow it to charge those rates which will bring it the most business at a profit just small enough to discourage competition. The yardstick proposed by the Supreme Court does not seem readily applied. No matter what may be stated by the rate-making body as the value of the plant, its market value (what would be paid by a willing buyer to a willing seller) is fixed by the earnings allowed, or prospective earnings, and the returns in similar businesses.

It seems to be time that the industry should reach an agreement on the fundamentals of what shall determine the value on which the public utility returns are to be based and what rate of return is necessary to maintain that value. Many investors and some commissions will contend for actual investment. This does not seem proper for two reasons: First, it is conceivable that a plant may be built at a time of very low cost and afterward sold on a very high second-hand market for more than its original cost. Second, it is not likely that the public will willingly continue to pay rates high enough to give proper returns on a high-cost plant after the period has arrived when a new plant could be built at a cost that would save customers a good portion of their rates.

The writer suggests as a basis for valuation the future cost of reproducing the plant and business in the present condition. The cost of reproduction new, less

depreciation, based on present and average prices, the historical cost and the actual investment should be merely bases from which to guess the future. Of course, this is merely a guess, but it is only putting the guessing up to the rate-making body, which is perhaps in a better position to study all of the factors, rather than leaving it to the buyer and the seller. The writer believes that this future cost has been quite a factor in a good many valuations, though not specifically recognized.

As to the rate of return, the writer believes that the best guide to the value of investment in a business of small risk but which requires careful study of the public is the earnings of the banks. Therefore it is suggested that the earnings of the banks of a locality be taken as the general guide as to the rate of return necessary in the public utility business of that locality. Of course, the probable decrease in value of any investment necessarily made at a time of high cost should be recognized in the item of depreciation.

F. V. GALLAUGHER.
Lake Charles Railway, Light & Water Works Company,
Lake Charles, La.

## Grounding Low-Voltage Secondaries

*To the Editor of the* ELECTRICAL WORLD:

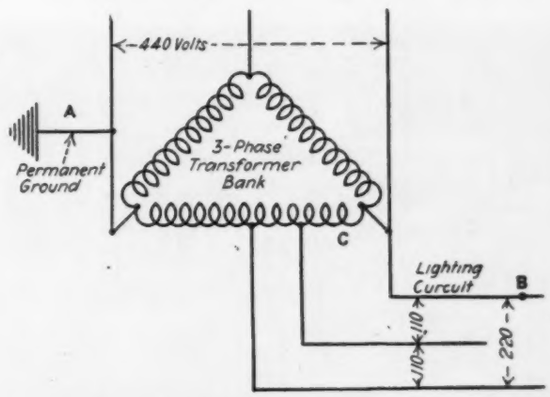
SIR: Considerable discussion as to the grounding of secondary circuits is in progress at the present time. The item on page 318 of the Feb. 5 issue of the ELECTRICAL WORLD sets forth a situation that is hazardous but which does not seem to be fully understood, the question having been raised as to how a fatality could occur in such a case. The following may help to answer some questions that are asked.

Referring to the figure showing the grounding in the above item, it will be seen that the man who grounded the lighting circuit through his body at *B* put himself directly across the 440-volt circuit and, of course, received practically the full voltage through his body. Such a condition is not necessarily fatal. Whether or not sufficient current to kill will be passed through a man's body at this voltage depends on his physical condition and the thoroughness of his contact with the ground. There is always danger that such a shock may be fatal.

In general it is pretty thoroughly established that if a man is in good physical condition a shock at full voltage from an ordinary 110-volt lighting circuit is not dangerous, though it may be so to a person with a defective heart or other organic trouble. The danger is so small that the protection secured by grounding a lighting circuit to limit the voltage to ground to the normal voltage of the lighting circuit outweighs it, and grounding for such circuits is universally recognized as good practice. As the voltage of the circuits increases the hazard to life from accidental contact increases, and it is seriously questioned whether on, say, voltages around 200 to ground the hazard to life from accidental contact with the circuit does not equal or exceed the protection against abnormal voltages on the circuit due to transformer breakdowns or accidental contact between high-voltage or low-voltage circuits. For example, if one neutral on a 220-volt, three-phase delta bank of transformers is grounded, the voltage between the grounded neutral and the third-phase wire is 110 (voltage between neutral wire and its own phase wires) multiplied by 1.73 (square root of three), or 190. On a 440-volt, three-phase bank with one neutral grounded the maximum voltage to ground is 220 multiplied by 1.73, or approximately 380 volts. Several combinations giving various voltages to ground can be readily worked out in this way.

One practice that is just now receiving a great deal of criticism is the use of auto-transformers to obtain three-wire lighting circuits from three-phase power circuits of, say, 220 or 440 volts. It is possible to have abnormal voltages under trouble conditions that may be a life hazard and are surely a hazard to apparatus on the circuit.

After a full and very lengthy discussion of the situation the Bureau of Standards Safety Code calls for grounding of circuits where voltages to ground do not exceed 150. Above that grounding is optional. The limit is purely an arbitrary one and is based on evidence




GROUNDING ARRANGEMENT THAT IS DANGEROUS

that apparently indicates it as the approximate line marking a balance between hazards due to accidental contact with the normal grounded circuit and those caused by contacts with an underground circuit carrying an abnormal voltage due to abnormal conditions. There are a great many who contend that grounding should be compulsory at considerably higher voltages to ground than 150, but the question can only be answered on the basis of evidence that is not yet available. The evidence is the study of accident statistics.

Chicago, Ill. J. LARKIN.

## Checking Meter Connections

*To the Editor of the* ELECTRICAL WORLD:

SIR: In the April 2, 1921, issue of the ELECTRICAL WORLD W. B. Kouwenhoven refers to my article in the issue of Feb. 26, describing a simple method of connecting a three-phase meter with current transformers only and checking the connections after installation. Professor Kouwenhoven asserts that this check is not infallible and refers to his classic paper in the *A. I. E. E. Proceedings* for February, 1916, on the subject of polyphase wattmeter connections. He has evidently overlooked my statement that the meter used is of the house type with but one voltage terminal (which he designates as "class C"), for he says specifically in the paper referred to that the method of checking by opening this voltage terminal is correct for a class C meter. The particular point made in my article was the advantage of using a house-type meter on a current-transformer connection.

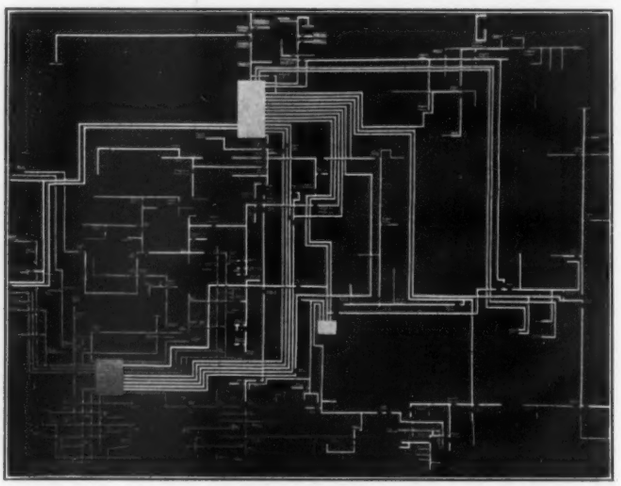
HALBERT R. THOMAS.
Southern California Edison Company,
Los Angeles, Cal.

# Station and Operating Practice

**A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy**

## Plug Board for Primary-Line Switching Control

CONTROL of primary-line switching in connection with routine operation, construction changes and maintenance is greatly facilitated on the system of the Cumberland County Power & Light Company, Portland, Me., by the plug board shown here, which was recently



COLORED STRIPS OF HEAVY PAPER REPRESENT LINES ON THIS SWITCHING MAP

installed at the offices of the line department. Using a base scale of about 3 ft. per mile, the 2,300-volt primaries were laid out approximately to map locations, the lines from different substations being shown in yellow, green, white and blue to speed up identification. The diagram is 10 ft. 2 in. x 5 ft. 8½ in. in length and height and consists of pine boarding, painted and varnished, on which strips of "tough check" paper ¼ in. wide are fastened to simulate three-phase lines, ⅛-in. strips of the same material being used to indicate single-phase branches. The base is of pine 1¾ in. thick and of strips 10 in. wide with joints doweled and glued, a saw scarf being cut every 3 in. and carried within ⅜ in. of the surface.

Switches are indicated by colored plugs fitting holes bored into the baseboard, and cross-overs of one line above another are represented by carrying the paper strip across the line on a semi-circular piece of ½-in. beading ¼ in. long. Line tie switches are indicated by hexagonal-headed pins painted red and green for showing closed or open circuits, and sectionalizing switches are shown as round pins half red and half green to facilitate reversal. Street intersections and unusually important buildings, etc., are indicated by tags, tie lines are numbered and primaries are lettered.

No work can be done upon the outside lines involving the opening or closing of line switches without proper orders from the headquarters office in which the plug board is installed, and all changes in line-switch openings and closings are at once made on the board to keep the status of the system up to the moment. It is planned to provide each important substation with a smaller board showing the line and switching conditions in its own distribution system to be operated in accord with the main primary dispatching board. The board eliminates the drawbacks of depending upon log sheets and daily report forms for up-to-the-minute information as to the status of lines and switches.

A. F. JORDAN and W. L. FOSS.
Cumberland County Power & Light Company,
Portland, Me.

## Measuring the Resistance of Transformer Grounds

PERIODIC measurement of the resistance of 2,300/-220/110-volt transformer grounds should prove cheap liability insurance. A visual inspection will not disclose defects such as improperly soldered joints or a ground rod too short to reach the permanent moisture level. However, with an instrument such as is described below accurate measurements may be quickly made. Moreover, the device can be built with a voltmeter and a few simple parts which are usually on hand in any meter department.

On a circuit which has more than one ground this method, of course, gives the resistance of all grounds in parallel. To determine the resistance of one ground all other grounds must be removed during the test. In case there is an accidental ground on the circuit the instrument will usually detect it.

Advantage is taken of the fact that a water pipe is convenient of access on nearly all premises supplied with electric service. The resistance of the water-pipe system and the transformer grounding device, in series, can be easily determined by the use of a known resistance and a voltmeter. The diagrammatic arrangement is shown at *A* in Fig. 2. *T* is a distributing transformer supplying a secondary system having the neutral grounded. *S* is a service connection. A known resistance, *R*, is connected between the ungrounded side of the service connection and the faucet of the water-supply system. The voltmeter *V* will indicate the potential across the resistance *R* plus that across the ground and piping system in series (line potential), this resist-

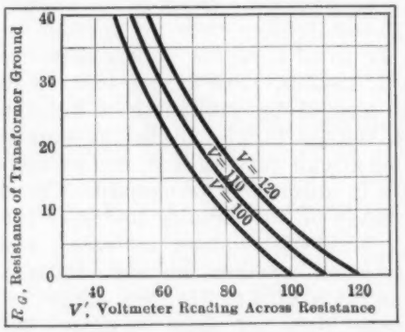



FIG. 1—RESISTANCE OF GROUNDS CORRESPONDING TO VOLTAGES ACROSS 35 OHMS IN SERIES

ance being $R_G$. The voltmeter $V'$ will indicate the potential across the resistance $R$. Since the same current flows through $R$ and $R_G$ their relative resistances are proportional to the potentials across them. Therefore $R/R_G = V'/V - V'$, or $R_G = R\ (V - V')/V'$. If, on making a test, it is found that $R_G$ is less than the allowable limit for a transformer ground (25 ohms), the resistance of the transformer ground itself will be within this limit, for it is the resistance $R_G$ less that of the piping system.

The device, to be convenient to use, should be capable of attachment to a lamp socket and should have a switch to transfer the resistance connection to the ungrounded side of the distribution system without changing connections at the lamp socket. These conditions are met by arranging the apparatus as shown at $B$ (Fig. 2), which also does away with the use of two voltmeters.

The method of using the device is as follows: Open switch $S_L$ and throw switch $S_V$ down. Fasten the clip to water faucet and screw the plug into the lamp socket.

| Transformer | $V'$ | $V$ | $R_G$ |
|---|---|---|---|
| No. 1 | 99 | 100 | 0.2 |
| No. 2 | 12 | 110 | 236.4 |
| No. 3 | 98 | 110 | 4.0 |
| No. 4 | 88 | 110 | 9.0 |
| No. 5 | 96 | 110 | 5.8 |
| No. 6 | 86 | 110 | 10. |

After closing the socket switch close switch $S_L$ in that position, which causes the voltmeter to read. This may be up or down, depending on which wire of the socket is the neutral. If the meter reads for both positions of $S_L$, there is an accidental ground on the conductor of the line which is not supposed to be grounded. Note voltmeter reading ($V'$) and throw switch $S_V$ to the upper position and read voltmeter again, obtaining line potential ($V$). Calculate $R_G$. Since the variations in line potential are usually small, time can be saved by calculating $R_G$ for several values of $V'$ and plotting a

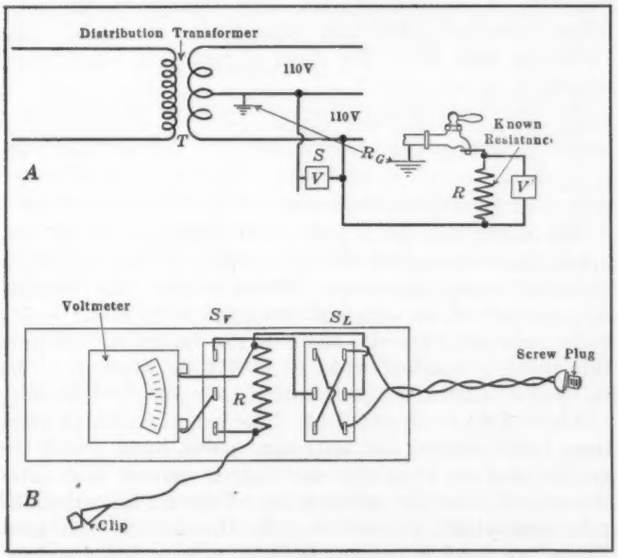



FIG. 2—CONNECTIONS FOR MEASURING RESISTANCE OF TRANSFORMER GROUNDS

set of curves, one for each value of line potential, as shown in Fig. 1.

The device, as constructed from materials which can readily be obtained at any electrical supply house, is shown in Fig. 3. The resistor is composed of a couple of radiant heater units connected in series, giving a resistance of 35 ohms. The voltmeter is an ordinary portable instrument, such as every electric power station should have on hand. The test set shown weighs 8 lb. (3.6 kg.), including the voltmeter.

On testing the transformer grounds for successive transformers along one primary main the results shown in the accompanying table were obtained.

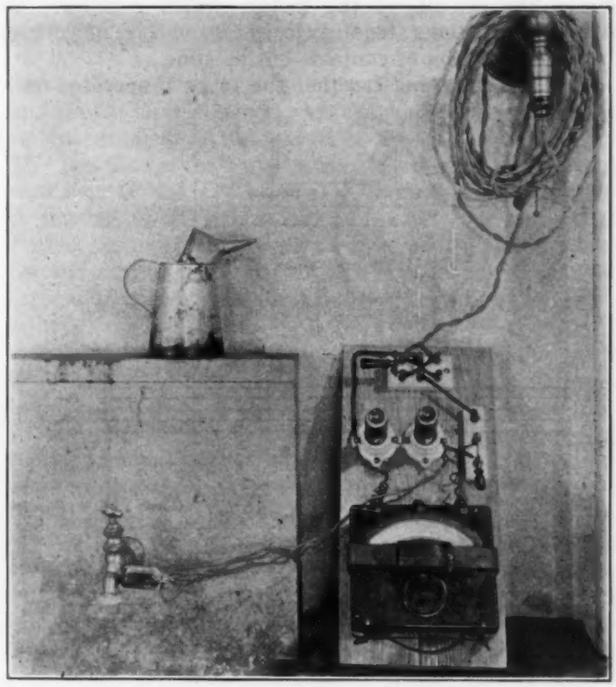


FIG. 3—INSTRUMENT FOR MEASURING RESISTANCE OF GROUNDS ATTACHED TO SOCKET AND WATER FAUCET

The furthest transformer was placed one mile (1.6 km.) from the starting point, and the entire set of tests was made in one and a half hours, including return to the starting point, the tester walking the entire distance.

ARTHUR H. FORD,
Electrical Engineering Department.
State University of Iowa, Iowa City.

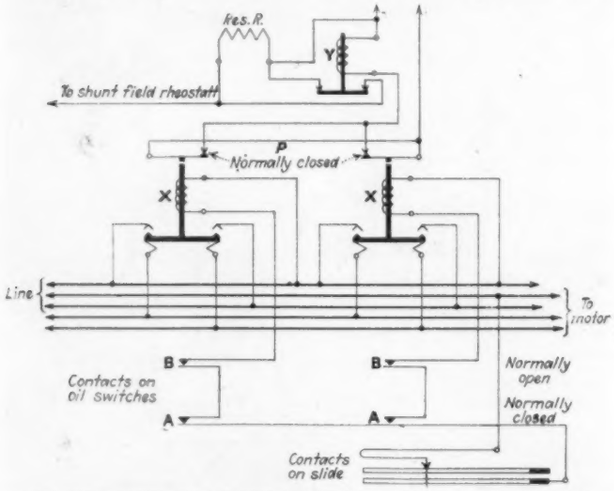
## Protecting Waterwheels Against Overspeeding

IN THE parallel operation of two hydro-electric stations it was found necessary to take the governors out of service in the smaller station, the load being controlled by the larger one. This system of operation was quite satisfactory until modern equipment was installed which included the installation of automatic circuit breakers on the generator and tie line to the other station. The opening of either of these breakers would cause a total loss of power, and the wheels would attain a dangerous speed, since there was no control over the gates, which were usually set at 80 per cent of full opening. To prevent this a system of control was worked out and installed which eliminated any further danger from racing wheels and consequent excessive potential in the windings of the generator and auxiliary equipment.

In the accompanying diagram of the connections it will be noticed that the oil switches have two control contacts in series, mounted at a convenient place in connection with the operating mechanism of the oil switch, which is similar to that used for pilot-lamp indicators. The front contact remains closed at all times, except

when the switch is opened by hand and the switch handle is left in the uppermost position. As the circuit breaker is opened by the relay, the back contact *B* closes, which completes the circuit through the contact slide at the governor to relay *X*. The contacts on the slide may be set for any desired gate opening, being connected directly to the indicator on the governor. The relay *X* closes the circuit of the motor, which continues to operate until the gates are closed, depending, of course, upon the position of contacts on the slide.

It will also be noticed that the relay *Y* operates on a




ARRANGEMENT FOR CLOSING GATES WHEN WATERWHEEL OVERSPEEDS

closed circuit, direct from the exciter or exciter bus, and short-circuits the resistance *R* under normal operating conditions. However, when the coil of relay *X* is energized contact *P* opens, thus opening the circuit to relay *Y* and cutting resistance *R* in series with the shunt field of the exciter, which reduces the exciter potential and in turn lowers the alternating-current voltage.

When the motor circuit opens, owing to the contact slide opening at the governor, and the coil in relay *X* becomes de-energized, contact *P* closes, but with the resistance *R* in the circuit the exciter voltage cannot rise sufficiently to close relay *Y*. However, when once closed this relay will remain so on a potential of about 30 volts. On bringing the exciter voltage slightly above normal for an instant, by the aid of the field rheostat, relay *Y* will close, thus short-circuiting resistance *R*. The voltage may then be brought to normal and the gates regulated, completing the cycle of operation.

Keystone Elec. Construction Co. J. W. TRUESDELL,
Baltimore, Md. Supt. of Construction.

## Estimating Peak Load on Distribution Transformers

FOR determining the peak load on transformers which supply residence lighting and range loads without going to the expense of making actual measurements, the following rule has for a number of years been used with success by the Utah Power & Light Company: For residence lighting loads assume 100 watts per customer. For range loads assume 800 watts per range. From time to time this rule is checked by actual measurement as shown in the next paragraph.

Typical results of such a check are as follows: Size of transformer, 15 kw.; number of lighting customers, 36; number of ranges, 15. Peak kw., estimated by rule: Thirty-six lighting customers at 100 watts, 3.6 kw.; fifteen ranges at 800 watts, 12.0 kw.; total, 15.6 kw. Peak by measurement, 14.4 kw. Connected load: Lighting, 23.04 kw.; ranges, 79.61 kw.; total, 102.65 kw. Ratio of peak to connected load: Estimated, 15.2 per cent; measured, 14.1 per cent.

This test was made on March 31. Had it been made in December or January, when the lighting load is highest, the estimated and actual peaks would have checked still more closely.

PAUL P. ASHWORTH,
Engineer of Distribution.
Utah Power & Light Company,
Salt Lake City, Utah.

## Value of Notching Poles Before Treatment with Preservative

ADVANCED practice in pole treating is now taking the form of notching or puncturing the outer fibers of wooden poles to obtain a deep penetration of preservative. However, the increased life to result from this treatment should be balanced against the total cost of the treatment. The damage done to the fibers should be offset by the sum of the following: (1) An increase in life to offset the lost diameter; (2) an increase in life to offset the cost of puncturing, and (3) an additional increase in the life of those poles that give a full physical-service life sufficient in amount to amortize the puncturing cost of the many poles removed for functional reasons before the end of their physical life. The functional reasons might be the need of a larger pole, moving the line to another location, replacement by underground work, etc.

Regarding the first requirement of offsetting the lost diameter, as pointed out in the writer's article on pole life in the ELECTRICAL WORLD of Jan. 31, 1920, the strength of a pole is proportional to the cube of its diameter at the ground line. Any damage to the outer fibers therefore materially reduces its strength. The following table shows the effect of cutting a ½-in. groove around a 12-in. pole:

| Diameter at Ground Line ($d$), In. | Cube of Diameter ($d^3$) | Proportional Strength, per Cent |
|---|---|---|
| 12 | 1.728 | 100 |
| 11 | 1.331 | 77 |

The usefulness of a pole, aside from functional depreciation, is a matter of the strength of the remaining unrotted sound diameter. When a pole has reached one-quarter of its original strength it is about ready to be removed. On the basis of the foregoing example this point is reached when $d^3 = 432$ or when $d = 7.6$ in. The allowable penetration of rot is therefore $(12.0 - 7.6) \div 2 = 2.2$ in. The examination of more than 1,000 treated and untreated poles, upon which the article of Jan. 30, 1920, was based, showed that after the second year the penetration of rot on an untreated pole was about proportional to the age of the pole. Therefore the ½-in. groove in this instance has, in effect, reduced the life $0.5 \div 2.2 = 23$ per cent.

The two other requirements may also be computed, taking into account the local conditions of pole costs and the character of the use of the pole line, and a complete formula may be worked out. The depth of notch which gives the greatest saving in annual pole charges should be employed.

PAGE GOLSAN.
Ford, Bacon & Davis,
New York, N. Y.

# Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

## Operating and Maintaining Portable Electric Drills

FOR obtaining best results from a portable electric drill it must be operated intelligently and troubles must be remedied before they become serious. A universal motor is the source of power for the drills most commonly employed. If severe sparking appears at the armature, the machine should be taken out of service at once and inspected. Grounds may be detected with a magneto ringer, and if no ground is detected in the armature, the field, switch and cable connections should be tested. An open circuit in the armature will be shown by burning between the commutator bars to which the open coil is connected. A short circuit within a coil will burn out the shorted turns and a short circuit between commutator bars will overheat the bars so shorted. A short circuit between bars may sometimes be repaired if discovered before the coil is burned by removing the foreign substance between the bars, but an open or shorted coil requires rewinding.

If the armature is built with open slots and form-wound coils, the repair can often be made economically by the average repair man if he purchases the repair coils from the maker. If the armature is built with semi-closed slots, it will probably be best to return it to the maker for rewinding. The maker's guarantee of correct rewinding is quite valuable, hence it is strongly recommended that the maker be asked to make repairs.

The fields are not apt to fail, but occasionally they are burned out by operating the tool after the armature has failed. A shorted field coil will cause overspeed or flashing when the switch is closed. Rewinding the field coils is simple provided that the coil is kept within the dimensions of the original and properly fastened in position. The best tools have windings treated with an impregnating varnish by an elaborate process which is a very good reason why a "rewind" by the maker is preferable. This feature is perhaps more important in the armature than in the field.

It is imperative that only such brushes be used as are furnished by the maker for the particular machine. A brush made from any material at hand may ruin the motor. Some of the effects possible are overheating from friction, sparking or high resistance. If the material is too hard, the friction and wear on the commutator are excessive, and if too soft, the mica may wear high and bring on chattering and destructive sparking. If the resistance of the brush is too low, excessive short-circuit current will cause sparking and overheating of the commutator and armature coils; and if the resistance is too high, the normal current may overheat the brush. The life of the brushes cannot be stated in ordinary terms because of the very great variation in the use of the tool. However, it is best to examine the brushes before the expiration of 200 hours' actual running time, and it will be a help to clean the commutator with fine sandpaper several times during the life of the brush. The tension on the brushes should be uniform and just sufficient to prevent arcing on a smooth commutator. A tension of at least 4 lb. per square inch of brush contact is usually necessary. Should the commutator become rough, the armature should be removed and the commutator refinished by taking a very light cut on a lathe.

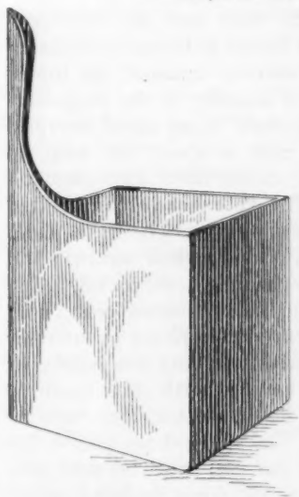
The cable connection is often abused by using it to drag the tool around, running trucks over it, etc. Some cable is better than others, but all of it requires reasonable consideration, and where the tool is used in one position on production work it is recommended that the tool and cable be suspended from above with a counterweight.

The gearing of the best machines seldom gives trouble, but gears are wearing parts and should be renewed if necessary. The better class of tools are lubricated by grease, which means maximum cleanliness and minimum attention. It is good practice to replenish the grease supply as often as the tool is cleaned or inspected, which on account of the brush wear should not exceed 200 hours of service.

Van Dorn Electric Tool Company, Cleveland, Ohio.

E. L. CONNELL, Chief Engineer.

## Tank Useful for Watering Batteries May Be Made from Old Jar



HANDY JAR FOR POURING WATER INTO BATTERIES

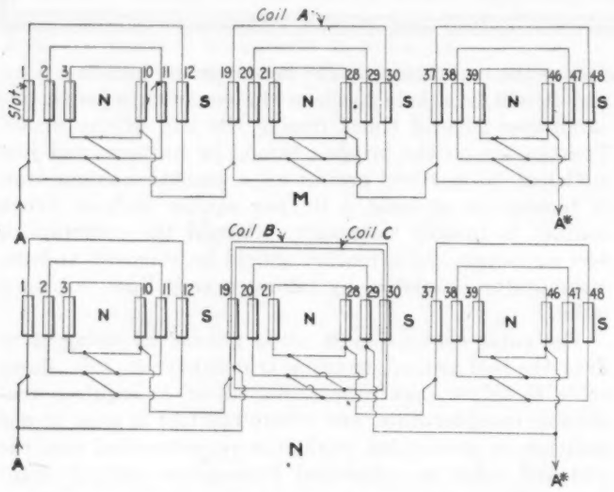
FOR adding water to batteries an old hard-rubber battery jar has proved valuable in the vehicle-battery department of the New York Edison Company. This jar is so cut as to form at one corner a neck which fits the hand comfortably. The water is poured from the opposite corner and may be concentrated in a fine stream.

This advantage and the fact that the jar is not easily broken made it preferable to the china pitcher often employed for the same purpose. Moreover, the cost may be said to be nothing as almost any shop has old jars which have been taken out of service on account of leaks, etc.

A. SHEINAUS,
Fore Battery Man, Auto Department,
New York Edison Company,
New York, N. Y.

## Halving a Motor's Voltage in a Difficult Case

A METHOD of halving the voltage of a motor which saved winding a large number of coils was resorted to recently in a large New York repair shop. There were nine coils connected in series in three groups for each




TWO PARALLEL CIRCUITS OBTAINED BY REPLACING COIL *A* (IN M) WITH COILS *B* AND *C* (IN N)

phase. The problem was to divide these nine coils into two equivalent parallel paths. This was solved in the manner described in the following paragraphs.

The motor was of the squirrel-cage type and was rated at 20 hp., 220 volts, three-phase, 60-cycle, 1,120-r.p.m. It had been rewound, but in attempting to run it at no load it was found that on applying the usual 50 per cent of line voltage the motor refused to start. The voltage was then increased to the 80 per cent tap of the auto-transformer, but without any better results. Finally, after applying 220 volts with no better success, it was decided to investigate the trouble.

While connected across 220 volts and not rotating, the current in each phase was found to be approximately 20 amp., and this in itself seemed unusual, as under these conditions the current is usually in the neighborhood of three to three and one-half times rated current, which would amount in this case to about 150 amp. to 200 amp. The stator winding connections were checked and seemed to be correct. The rotor had been welded and the bearings were in good shape. The data sheet was next consulted, and this was checked against the stator winding and here the trouble was found. The stator had fifty-four slots and twenty-seven coils, concentric-wound, consisting of three pole-phase groups per phase and three coils per group, creating six poles per phase. The stator had been rewound with coils made up of twenty turns of one No. 10 double-cotton-covered wire each, connected series-star. The data sheet called for ten turns of two No. 10 wires per coil in series-star connection. It is evident that the coils were made up incorrectly, as under these conditions the motor would have had the necessary turns to operate properly on a 440-volt circuit.

Under the existing conditions the question then arose as to the best method of rectifying the trouble without entirely rewinding. It was evident that the winding would have to be reconnected two-parallel star in order to operate this motor on a 220-volt circuit. As there were nine coils in series per phase connected, as shown at *M*, it was seen that an uneven number of pole-phase groups would present a fairly difficult winding to divide into two circuits. It was finally decided to remove coil "A" shown at *M* and make up two coils of No. 10 with ten turns each and put these two coils back into the same slots, insulated from each other, to form two separate coils as "B" and "C" at *N*, this being done to the same relative coil in each of the three phases, which made it necessary to make up a total of six of these coils. The winding had 180 turns in series per phase and under the original conditions could not be divided into two equal circuits. Under the new arrangement of connections as shown at *N*, a parallel connection was obtained with ninety turns in each circuit. After reconnecting in this manner the motor was tested and was found to operate quite satisfactorily.

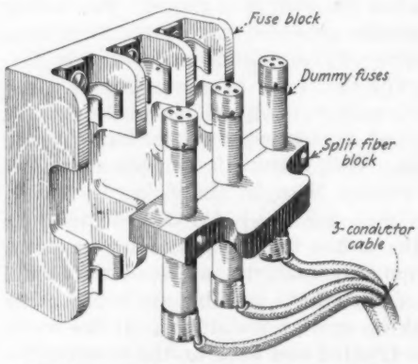
E. R. DEBMAN.

East Orange, N. J.

## Non-Reversible Attachment Plug for Three-Phase Motor

FOR connecting a three-phase motor at any one of a number of locations in a Connecticut brickyard a non-reversible attachment block has been made. This is a 5-hp., 440-volt motor which operates a conveyor cable carrying bricks from the drying racks to the burning kilns, and as the work is shifted from one locality to another it is necessary to move the motor about.

If the leads become exchanged, the motor is liable to run in the wrong direction. This difficulty was overcome in a rather crude but practical manner by placing on every other post a three-pole, 600-volt inclosed fuse block about 15 ft. above ground so as to be well beyond the reach of any truck. To all these fuse blocks, eight in number, the three-wire main line is connected. A fiber block was made to clamp securely three inclosed fuses in each of which a No. 10 copper wire was soldered in place of the regular fuse and to the ferrule of each was soldered one conductor of a flexible cable leading to the motor. The fiber block is shaped to form a good grip for the hand. As the leads are all solidly connected there is no danger of reversing the motor. The line is protected by another fuse block carrying 30-amp. fuses. The leads to the motor consist of a three-wire stranded cable heavily insulated. By means of a fiber strain clamp the cable is hooked up on the post so that the pulling strain will not come on the plug connections. At the motor there are a switch and 25-amp. fuses, the cable merely making the connection to the main line.




LEADS TO MOTOR CANNOT BE REVERSED WHEN USING THIS PLUG

This one attachment plug, made up by the company's mechanic, and the eight fuse blocks cost for labor and material about $20.

H. S. RICH.

East Berlin, Conn.

## Power Required for Oil-Well Drilling

THE power requirements for an electrically driven drill in use in the El Dorado oil fields of Kansas are shown in the accompanying curves. The full curve (Fig. 2) shows the total consumption for various depths, while the dotted line represents the kilowatt-hour requirement per foot of depth. The increase in power required as the depth increases is clearly shown. This is due to the weight of drilling equipment and the increased "kick" that must be applied to the line in order that the drill bit shall get its necessary rise in height from the bottom of the hole.

MATERIAL STRUCK AT DIFFERENT DEPTHS WHILE DRILLING OIL WELL—TOTAL DEPTH 2,443 FT.

| Depth Drilled (Ft.) | Kind of Material Struck and Thickness of It | Depth Drilled (Ft.) | Kind of Material Struck and Thickness of It |
|---|---|---|---|
| 0 | 10-ft. lime | 1,126 | 27-ft. lime (hard) |
| 10 | 30-ft. blue shale | 1,153 | 3-ft. shale |
| 40 | 12-ft. lime | 1,156 | 60-ft. lime |
| 52 | 20-ft. shale | 1,217 | 9-ft. slate |
| 72 | 14-ft. lime | 1,227 | 40-ft. lime |
| 86 | 121-ft. shale | 1,268 | 50-ft. shale |
| 207 | 6-ft. lime | 1,319 | 36-ft. lime |
| 213 | 73-ft. shale | 1,356 | 25-ft. shale |
| 286 | 2-ft. red rock | 1,373 | heavy flow gas |
| 288 | 20-ft. lime | 1,382 | 35-ft. lime |
| 308 | 5-ft. shale | 1,418 | 20-ft. shale |
| 313 | 16-ft. lime | 1,439 | 10-ft. lime |
| 329 | 95-ft. shale | 1,450 | 52-ft. shale |
| 424 | 18-ft. lime | 1,503 | 18-ft. water sand |
| 442 | 53-ft. shale | 1,522 | 47-ft. slate |
| 495 | 7-ft. lime | 1,570 | 4-ft. oil sand |
| 502 | 46-ft. shale | 1,574 | 16-ft. shale |
| 548 | 19-ft. lime | 1,590 | 15-ft. slate |
| 567 | 47-ft. shale | 1,605 | 45-ft. lime |
| 614 | 9-ft. lime | 1,660 | 12-ft. sand |
| 623 | 10-ft. oil sand | 1,672 | 6-ft. shale |
| 628 | ..... | 1,678 | 79-ft. sand |
| 633 | 7-ft. sandy shale | 1,760 | 9-ft. shale |
| 640 | 36-ft. blue shale | 1,770 | 20-ft. lime |
| 676 | 15-ft. shale | 1,792 | 50-ft. sand |
| 691 | 10-ft. lime | 1,845 | 45-ft. shale |
| 701 | 35-ft. shale | 1,895 | 10-ft. lime |
| 736 | 55-ft. lime (hard) | 1,905 | 52-ft. shale |
| 791 | 9-ft. shale | 1,965 | 18-ft. lime |
| 800 | 38-ft. shale | 1,984 | 15-ft. shale |
| 838 | 4-ft. lime | 2,000 | 40-ft. lime |
| 842 | 34-ft. slate | 2,041 | 27-ft. sand (oil) |
| 876 | 45-ft. lime | 2,069 | 27-ft. lime |
| 921 | 8-ft. shale | 2,097 | 54-ft. sandy lime |
| 929 | 30-ft. lime | 2,152 | 142-ft. slate |
| 959 | 10-ft. shale | 2,297 | 6-ft. lime |
| 969 | 10-ft. lime | 2,303 | 11-ft. slate |
| 979 | 8-ft. shale | 2,314 | 52-ft. lime |
| 987 | 4-ft. slate | 2,366 | 2-ft. red rock |
| 991 | 52-ft. lime | 2,368 | 55-ft. shale |
| 1,043 | 9-ft. shale | 2,423 | 2-ft. sandy lime |
| 1,049 | 56-ft. lime } gas | 2,425 | 10-ft. slate |
| 1,108 | 18-ft. slate } | 2,435 | 8-ft. sand (oil) |
| | | | Total depth 2,443 |

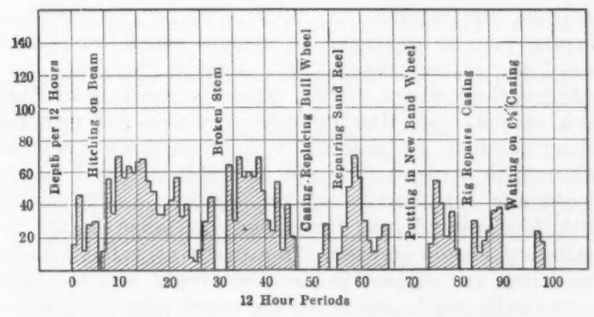



FIG. 1—PROGRESS OF DRILLING 2,443-FT. OIL WELL

Fig. 1 is a record of the progress of drilling, showing the depth drilled in each twelve-hour period. The materials through which the drill went on its downward course are listed in the accompanying table. They consisted principally of lime and shale. The actual number of drilling days was thirty-four, and sixteen days were required for repairs, making a total of fifty days. The maximum depth drilled per day was 126 ft., while the average was 72 ft. The driving motor was a 75-hp., 440-volt, three-phase slip-ring machine.

Chicago, Ill. FIELD EDITOR ELECTRICAL WORLD.

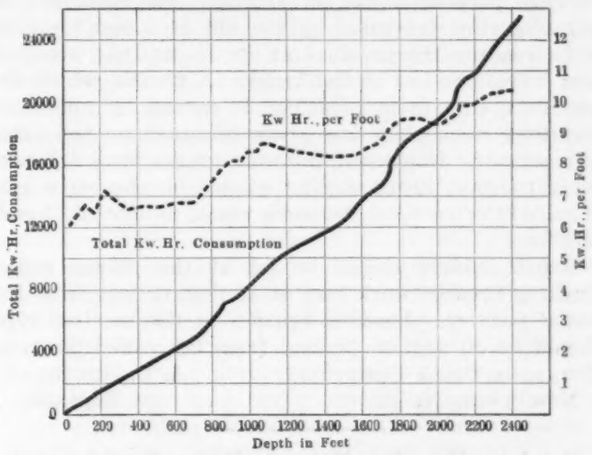



FIG. 2—ENERGY CONSUMPTION IN DIGGING OIL WELL

## Proper Fit and Correct Pressure of Brushes Help Commutation

PROPER fitting of brushes and correct adjustment of pressure are necessary to insure the longest brush life and to prevent burning commutator or slip rings. Lack of care in fitting brushes to the commutator when first installed is a common fault which has caused more brush failures than any other. The final fitting should be done with very fine sandpaper. Then, after the dust has been blown out of the machine, see that the brushes move freely in the boxes. Adjust the spring tension so that it is approximately equal on every brush, and if it is possible, run the machine without load until the brushes make good contact across their entire faces. It is not always true that a brush poorly fitted at the start will soon wear under load to form a good contact. A brush, particularly one of the carbon grades, if subjected to sparking caused by poor contact, may have its contact face so pitted that it will never wear down to a proper seat. The reason for this is plain. For instance, consider an ordinary carbon brush, rated at 35 amp. per square inch and working at 30 amp. per square inch. If the brushes are making contact on only one-fourth of their faces, the current density in this portion is raised to approximately 120 amp. per square inch, which is far beyond the carrying ability of the material. Therefore, the heat generated at these points may be sufficient to cause cratering as described.

Emphasis is placed on the need of making pressures equal on all the brushes of a machine because of the great effect pressure has on contact resistance. At a pressure of 1 lb. per square inch the contact drop, negative plus positive, of an ordinary carbon brush at 40 amp. per square inch, with a speed of 3,500 ft. per minute, may have a value of 2.2 volts, while at 3 lb. per square inch the contact drop may be only 1.5 volts. The contact resistance has accordingly been decreased in the proportion of 1.5 to 2.2. Since current divides

inversely proportional to the resistances of parallel circuits, it is readily seen how unequal the current distribution will be among brushes which have widely varying pressures. It is strongly recommended to adjust spring pressures by the aid of a small spring scale, reading the pressure at the instant the pressure arm leaves the top of the brush. A trouble which depends on this same principle is caused by operators installing more than one grade of brush on the same commutator. In general, different grades have different contact drops, hence mixing grades on the same machine will often have the same result as unequal brush tension.

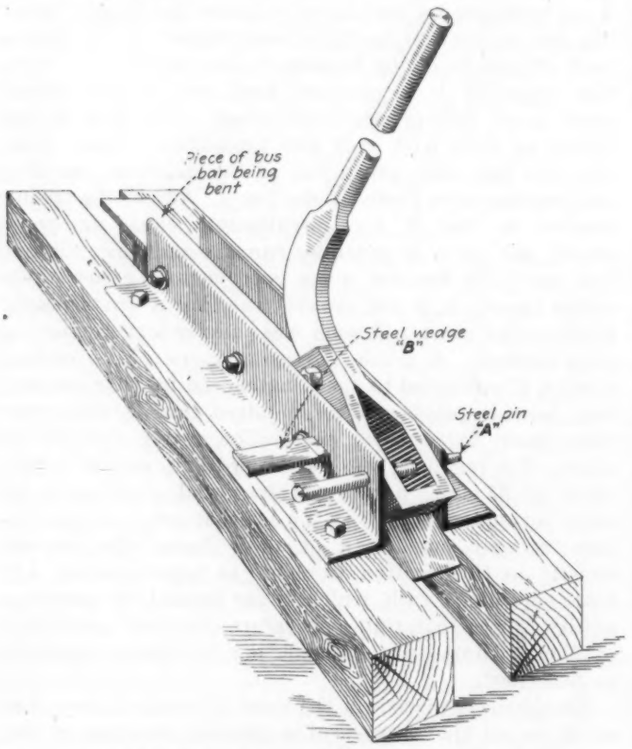
Brush holders should be set at the proper angle. Trailing brushes work best at 15 deg. or less from the radial position. Leading brushes of the reaction type should be 30 deg. to 40 deg. from the radial position.

Morganite Brush Company, New York, N. Y.

A. L. HEATH, Engineer.

## Busbar Bender Which Does Quick and Effective Work

A BUSBAR bender that is very speedy and at the same time makes perfect bends is shown in the accompanying drawings. By referring to the assembly drawing it is seen that the bar to be bent is laid in the bending frame and held by the steel wedge *B*, which passes through both sides of the frame. The bending lever is pivoted on the steel pin *A*, and by exerting a downward pressure on the handle of the bending lever

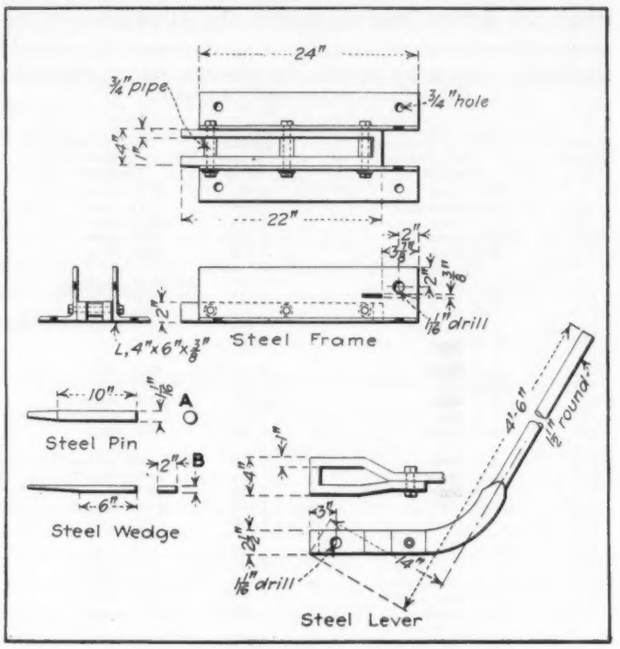



THIS BENDER WILL ACCOMMODATE BUSBARS UP TO ½ IN. X 4 IN. IN SIZE

any degree of bend can be obtained. A bender of this type is suitable for all bars up to ½ in. in thickness and 4 in. in width.

For bending busbars many devices have been developed, the most common of these being the V-block and the inverted V-block between which the bar is placed.

The pressure is usually applied with a small hydraulic jack. The great drawback to the use of this bender is the length of time necessary to complete a




DETAILS OF PARTS OF BUSBAR BENDER

bend and reset the blocks. The lever type of bender described here overcomes these objections, and after some practice even an inexperienced man can turn out good work.

R. H. N. LOCKYER.

Bonnington Falls, British Columbia.

## Motor Requirements for Meeting Unusual Service Conditions

MANY times the engineer of a plant in casting about for a motor suitable for an unusually severe service is somewhat at a loss to know the salient points of various types of motors with respect to their ability to survive the task of operating the exceptional drives. From experience gained in a plant using 25,000 hp. in motors it is evident that there are ways to decrease the number of motor failures by avoiding certain general features of design which have been found to create excessive maintenance charges.

In locations where carbon, excessive moisture or dust, such as soda ash, lime or caustic, which will combine with moisture to produce a low-resistance chemical solution, is present, it is not desirable to use a partly closed slot construction of the stator. An open slot, with form-wound coils taped and varnished before installation, should be used. In a partly closed slot motor the wires are slipped in the slot singly and the ends of the coils are taped up to the point where the wires enter the slot. For this reason it is very difficult to prevent carbon or chemicals from breaking down the joints of the insulation at the point of entrance.

Metallic wedges for retaining the coils in the slot have sometimes given trouble where the motor is subject to heavy overloads. These wedges are usually of light-weight material and sometimes warp out of place because of excessive heating and bind the rotor

so that the motor must be dismantled and the wedges removed.

In locations subject to an excessive amount of dust, with particular reference to dust having a high percentage of water chemically combined, it has been found desirable to eliminate the sheet-iron plates placed in the end bells for the purpose of deflecting the cooling air around the coils. The end bells should be as open as possible, otherwise the dust will build up around the coils and shut off the cooling air altogether. Too much confidence should not be placed in air ducts in stator laminations for ventilation of motors of 50 hp. and under. Usually an excessive amount of dust will clog them very easily.

For the above reasons concerning dust, and since oil and dirt cannot always be eliminated from the ordinary installation, frequently the coil ends become covered with a thick coating of dust which cannot be removed by blowing. For such an installation it has been found unwise to use a motor with a temperature rise of 50 deg. C.

On many pump drives provision cannot be made for taking care of the thrust of the pump except by the bearings of the motor. In selecting a motor for such a drive a clearance of at least 2 in. should be obtained between the rotor parts and the end bells to take care of the lateral wear of the bearings.

In motors of 15 hp. and up it is a decided advantage to have deep rotor bars designed to assist in ventilating the motor, as quite often fans attached to the spider are broken and remain unnoticed for some time. Rotor bars which are not welded or silver-soldered to the end ring give an unusual amount of trouble where the motors are subject to sustained overloads or in the presence of any oxidized dust which can find its way between the bars and end rings. Often a year will elapse before a motor will begin to show signs of a serious drop in speed, owing to high resistance joints in the rotor, but in cases where high temperatures in the motor exist for some length of time a rotor failure usually occurs in a short period.

In considering wound or slip-ring rotors it is very desirable, when the size of motor will warrant it, to use bar coils which may be taped and varnished before insertion in the rotor slots. The wire coils of more than one turn in partly closed slots are open to much the same objection as applies to partly closed slot stators in that they often fail when subject to excessively moist conditions or certain chemical materials.

Many slip-ring rotor failures may be traced to the improper application of slip-ring brushes, because the use of a brush too high in metallic or copper content invites trouble. The dust gets in between the coils and is very difficult to blow out. Sooner or later a leakage path is established by these metallic particles and a motor failure occurs. It is best to always refer such brush application problems to either the maker of the motor or the brush manufacturer for their recommendations.

The modern tendency in oil-well covers is to use a pressed or stamped metal cover secured by screws. In changing motors and when changing bearing bushing these screws seem to be invariably broken off, and it becomes quite an item of maintenance expense to tap the broken screws out and replace the missing lids when there are a large number of motors in the plant. The desirable construction seems to be a rather small opening covered by a cast lid with a substantial hinge.

In medium-size motors using two oil rings the inner ring is often put in from the inside of the end bell. With this construction, it is very difficult to maintain any sort of collar in place to seal the space between the end bell and the shaft. In the large motors it appears desirable to split the bearing housing in two halves and in the smaller motors to insert the ring through the opening in the top of the bearing housing. After one of these collars is broken, or when it cannot be kept in place, it is extremely difficult to prevent oil from being sucked out of the bearing housing by the fan action of the rotor. In many machines the oil overflow spout is not sufficiently protected from damage by belts, and when knocked off it is seldom discovered until the bearing has been ruined. Often it has been necessary to remove the oil overflows and substitute pipe plugs in order to prevent the unexpected draining of the oil well by a broken overflow.

The foot lugs of a motor should be extra strong in cases where a motor must be shifted from one location to another very often. It does not take a very severe bump to knock off a lug when a motor is slipped off a low foundation to the floor by careless mechanics. When a foot lug is broken it is very difficult to secure the motor to its foundation or sliding base, and welding is not always satisfactory. It is usually necessary to strip the winding out of the frame in order to make the weld.

It is not always possible to foresee every condition which may arise in connection with a new motor application, but by the careful selection of the proper characteristics of motor structure and design to suit the operating conditions, an endless repair bill may often be avoided. The writer believes, however, that the motor designers of today are keenly alive to the problems of maintenance and operation of their motors and are always glad to co-operate in adapting their equipment to meet unusual conditions.

St. Louis, Mo. J. ELMER HOUSLEY,
Electrical Engineer.

## Lumber Stacker Decreases Cost of Handling Lumber

STACKS LUMBER 26 FT. HIGH AT LESS EXPENSE THAN HAND PILING

A SAVING of 25 to 35 per cent in the cost of piling lumber in some yards of the Northwest has been effected by the use of the lumber stacker illustrated herewith. The machine not only saves time but will pile lumber to a height of 26 ft., or nearly twice the height possible by hand stacking, thus reducing the storage area required by nearly half.

A ½-hp. motor drives two endless chains to which arms are attached at intervals for elevating the lumber. The machine is portable, weighs 1,900 lb., and the height of the towers is 30 ft. In actual operation the elevator will pile lumber at the rate of 6,000 ft. per hour. W. C. HESTON.
Portland Railway, Light & Power Company,
Portland, Ore.

# Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

## Why Not Fixed Prices for Wiring Jobs?

BY KASSANDRA

IN THE old days no storekeeper had fixed prices for his goods. Then the idea came in, and today a store without fixed prices, a store where the buyer and storekeeper haggle and trade, is a sign of backward civilization. At the present time, in fact, there are very few businesses of any character that do not operate on the fixed-price basis. The utilities are obliged to do so by law, but even if they were not they would have fixed prices just the same. For imagine the New York Edison Company or the Edison Electric Illuminating Company of Boston, for instance, entering into a discussion with each customer as to the price per kilowatt-hour. As well imagine Wanamaker or Jordan-Marsh or Marshall Field operating on any but the fixed-price basis.

The utilities may have been forced by law to have fixed prices, but there is no law requiring stores to have fixed prices. The reason the big and successful stores have fixed prices is because it pays. If a store could have a minimum price marked secretly on each article and then let the salesman try to get all he was able, it could apparently double its net profit if the average mark-up were only 10 per cent. But without the fixed price, without the confidence of the customer, the overhead and cost of selling go up so fast as to wipe out all the gain. So progressive business men have established and standardized the policy of fixed prices.

The electrical industry, I believe, is suffering today because electrical wiring has not been put upon a one-price basis. The contractor still risks his profit by adapting his price to fit the job. Yet there is no real reason why a contractor cannot make a fixed price on most of his work as well as any other business man.

Some jobs, say wiring a big factory or a ten-story building, are so big that it pays to figure out each item, but this isn't true of the ordinary small jobs which make up the bulk of a contractor's business. On a hundred-dollar job the net profit, including overhead, is, or should be, something like $30. The wiring contractor can no more afford to spend time haggling over the price than a furniture dealer can afford to waste time haggling over $100 worth of furniture. With the still smaller jobs—say, for instance, the adding of convenience outlets to a house already wired—certainly there is no margin for cutting a price of $25 to suit a customer. The wiring contractor should have his fixed price for fixtures or switches, just as much as for flatirons or percolators or fuses or lamps. He may need several prices to take care of ordinary outlets (fixtures extra) and so much for a receptacle, or so much more if a new circuit is needed instead of adding the outlet to an existing circuit. He must have one fixed price for concealed work and another for wood or metal mending. The wiring and labor costs are so nearly the same that he can afford to average it, and by averaging and quoting a fixed price he can cut down the time spent in trading and haggling, and reduce his overhead but not his profit.

Let a wireman try advertising "convenience outlets put in ordinary locations at $..... each, including standard receptacles," and he will forge ahead of his haggling competitor just as the fixed-price store gets ahead of the store whose owner spends one dollar of his own time to get fifty cents in higher price. For the ordinary man would rather pay $6 or $8 for each new outlet and feel reasonably sure that this is the same price that others are paying to that wireman than to trade and haggle and pay a little less. On a fixed price he feels surer of quality. On a haggled price there is always a doubt as to whether the quality has not been skimped. A fixed price, however, does not mean that all the wiremen have the same price any more than fixed prices in groceries mean that every grocer has the same price. The high-class wireman should have a higher fixed price than the poorer wireman and can get it. He need not fear price cutting, because, although the poor wireman who announces a high price and then secretly cuts it may get one or two jobs, he will disappear just as the old-fashioned haggling store has disappeared and left the fixed-price store of today as the standard. The good store knows that some customers take more of the salesman's time than others, that some deliveries cost more than others, but it also knows that a fixed price which is the same to all pays best.

The wiring contractor, I believe, can establish a fixed price for, say, 95 per cent of his small jobs other than the repair jobs. It will pay the central-station company well to advocate this policy and aid the wiring man to work out and establish such a practice.

## Why Customers Should Invest in Utility Securities

IN ANNOUNCING the plans for offering its preferred stock to customers the Atlantic City (N. J.) Electric Company issued a statement to the local newspapers explaining why its securities are a good investment. Part of the company's argument was as follows:

"Every one around here knows the Atlantic City Electric Company and every one realizes how absolutely necessary it is to the daily life of Atlantic City and to the other communities it serves. But here is a fact that most folks do not know. Over 1,400,000 citizens of the United States have invested their money in the electric light and power business—it is believed a greater number than have invested in any other class of securities except Liberty bonds.

"Why? Because the securities of the electric light and power business have proved to be safe and because the dividends have been paid regularly, year after year. Our customers and other residents may now secure such an investment on very reasonable terms."

## Rural Rates Should Be Based on Value of Service

DECLARING that many existing rural lines are being operated at a loss and advocating the adoption by central stations of a rate which would be based largely on the value of the service rather than the kilowatt-hours used, N. T. Wilcox of Keokuk, Iowa, presented some interesting statements on the cost of rural service before the recent meeting of the Missouri Association of Public Utilities at Kansas City. He pointed out that in most cases an analysis of rural service discloses that cost conditions surrounding such service are materially greater than for town service.

Mr. Wilcox continued:

In reality the rural system is furnishing a valuable service and the customer is paying for a few kilowatt-hours instead of for the commodity that he is purchasing, which is a valuable service. The minimum charge exacted, if it exists at all, is absurdly small and no reflection of the actual value to the customer. Those who have grown up with the industry and have been consistent optimists and boosters are so because they realize that adequate and proper service, because of its many possibilities in practical application, is or at least may be an actual money maker for the customer as well as for the distributing company. Money can be made for the farmer even when the total charge for this service is many times the amounts popularly supposed to represent the sums possible to be obtained for rural service.

The statement that a good, well-managed, 160-acre farm in the Middle West can well afford to pay $50 per month for complete electric service at the present time may seem decidedly optimistic. But may we not venture to say that ten years hence this statement will be considered a most reasonable one? Let us consider the many practical applications of electric power to farm requirements. In the house we have lighting, cooking, refrigeration, fans and ventilation, cream separation, churning, water pumping and many other conveniences which go to lighten labor and make life pleasant. In the farmyard or about the place we may have electric power for lighting, grinding feed, sawing wood, pumping, cold storage, milking and various miscellaneous labor-saving applications where electric power is conceded to be superior to other powers.

A careful and competent analysis will reveal a possible saving of labor costs surprisingly large. It will also be discovered that in many cases the farmer can afford to pay $50 per month for service and out of his advantage still have another $50 yet for his own use as a result of utilizing this service, saying nothing of the fact that unlike labor the electric power is on the job and ready to do its part at any time during the twenty-four hours' time without a hint of strike or asking for an increased wage. The efficiency is also uniform instead of variable according to the health or mood of the laborer.

Educational work and good salesmanship, as well as common sense, together with commercial sense and energy, are required to succeed in really selling rural service. Time will also be required to develop this business, although much less than formerly owing to the general acceptance of the advantage to be derived from superior service. The point we desire to emphasize is that an opportunity is present for those men who recognize the fact that the supply of electricity to outlying and sparsely settled districts is a valuable service and to be charged and paid for accordingly. Territory must be carefully mapped out and studied in advance and careful and consistent plans of campaign laid out in order to insure success. Rates for service must be carefully considered beforehand. Inadequate hit-or-miss methods must not be tolerated. Twelve hundred to twenty-four hundred dollars per year per square mile served is all that we can probably expect from strictly farm service in the Middle West, at least so long as the farms average in size as large as at present.

Hamlets and small towns here and there will, however, tend to increase the totals. When we consider that a good-sized town, covering 10 square miles, can be made to supply an income of as high as $15,000 or $20,000 or more per square mile and at high load factor, we can readily see why the kilowatt-hour is the basis of charge in town and why the charge for service is of secondary consideration in this instance. In the country, however, we will be able to sell at most not more than 4,000 kw.-hr. or 5,000 kw.-hr. per month per square mile, probably less. It is evident from these considerations that the farmer must pay for his own transformers and meter equipment and for service—not for kilowatt-hours at the rates generally prevailing.

How shall we meet these conditions and assure an adequate and reasonable return for service rendered? It is quite evident that we cannot sell entirely on a kilowatt-hour basis, although we need a meter to check abuse and waste. It is also quite evident that we cannot read meters every month and furnish the same detail and expensive service required in town with its consequent high cost per customer. Automobile and truck service for country districts run up expense and must as far as possible be avoided. The low return per mile also means that we must have the lowest possible construction costs consistent with service. This construction must be such as not to subject the customer to any except quite unusual interruptions for the reason that the whole foundation of the business rests on satisfactory service. If we have poor lines and poor maintenance and supervision, we shall not be rendering the valuable service for which we should demand and receive an adequate return.

To allow comparatively low rates for the service we must have the best possible development of the territory served. This means intensive and energetic work so that the time required to develop may be reduced to a minimum, also satisfactory line construction such as will prove really economical in the long run and afford the satisfactory service that will be required to develop and hold the business.

Assuming that the working voltage for the main trunk lines is 33,000 and that branch lines are 6,600 volts, for the purposes of this estimate and of outlining the situation in a rough way, we approximate costs as follows:

| | Per Mile |
|---|---|
| Trunk lines, including right-of-way, etc. | $3,000 |
| Side lines | $1,200 to 1,500 |
| Taps | 1,000 |

In figuring costs something must be added for engineering, supervision, general and overhead expenses and interest during construction. Estimates generally lack these items, which may account for some wonderfully low estimates that have been reported.

Assuming that the territory served contains an average of four 160-acre farms per square mile and that only 50 per cent of possible customers are obtained, then the transmission-line costs, outside of allowance for generating plant, would appear somewhat as follows:

| | |
|---|---|
| Proportion of trunk line investment per farm inside of district served | $140.00 |
| Proportion of side lines and taps | 860.00 |
| Total | $1,000.00 |

Fixed charges, taxes, depreciation and interest at 15 per cent would be $150 per year, or $12.50 per month.

To this should be added at least $1 to cover patrolling and necessary meter reading. With 100 per cent development—that is with every farm served—the charge of $12.50 would possibly be reduced to $7 or $8 per month per customer, but as this cannot be expected for some time to come, the latter figure has not been used.

The above should be the minimum charge per farm before any allowance is made for kilowatt-hours used either in doing work on the customer's premises or for energy losses in lines, transformers, meters, and so forth. It is assumed also that the farmer will pay for his own meter, transformer, switch and, if necessary, lightning arresters, as well as for all lines on his own premises. In totaling these figures we are assuming a capacity of 5 kw. per customer and that each customer would require about 36 kw.-hr. per year for meter and transformer losses. In this

case we have assumed 1,200 kw.-hr. per year per kilowatt of capacity, or 6,000 kw.-hr. per year for each customer.

A summation of the above figures, together with kilowatt-hour figures for each customer, gives transmission-line charges of $150 a year plus $300, the price of 6,000 kw.-hr., at 5 cents per kw.-hr., or a total charge of $450 a year or $37.50 a month.

A 5-cent rate has been assumed, but this rate will vary materially for different locations. How many farmers are paying this amount? If they are not paying this amount, how much are we actually losing on this kind of service when we charge only $2 to $5 per month minimum?

This paper has been written in the hope that it would serve to bring out the important difference between farm service and city kilowatt-hour charges and to emphasize the fact that rural distribution is essentially based upon a valuable service—not on kilowatt-hours sold. Those who have analyzed these problems, especially as to costs, will realize the necessity of education and helpful suggestions. Well-constructed, not necessarily expensive, distributing lines, if periodically and intelligently inspected, entail comparatively low costs for patrolling and inspection and are most economical. Good construction always means low maintenance. This remark especially applies to the high-tension insulators. The 33,000-volt trunk lines, if used, will of course require more attention than the lower-voltage distributing lines, but if good construction and high-grade insulators are used—say a 50,000-volt insulator—this attention should be comparatively small.

From the nature of things most rural lines must be financed by the people benefited. Generally speaking, many lines are too poorly constructed and maintained to be worth more than the amount usually charged to the customer, but in this discussion of the problem we are considering a businesslike plan which will insure continuous service and which will be profitable alike to the customer and to the company furnishing the service. The mistake made by the average company supplying rural service is in failing to appreciate the fact that the service has a definite and appreciable value which, if properly demonstrated, will result satisfactorily to all concerned.

## Central-Station Office Fits Local Architecture

THE thick adobe walls and mission bells of New Mexican architecture are followed in the design of the office of the Santa Fé (N. M.) Water & Light Company. Although the building has no show window,

UNUSUAL DESIGN OF CENTRAL STATION OFFICE AT SANTA FÉ, N. M.

this apparent disadvantage is offset by a display of appliances arranged in the front part of the general office space, where customers paying their bills are reminded of the advantages of electric service.

## Illuminated Directory for Central-Station Office

AN ATTRACTIVE illuminated directory is installed at the offices of the Narragansett Electric Lighting Company, Turks Head Building, Providence, R. I., directly opposite the elevator entrances to the company's headquarters. It is designed in panels, with raised letters indicating the room numbers and titles

ATTRACTIVE OFFICE DIRECTORY OF PROVIDENCE COMPANY

of various officials and the locations of departments and divisions. Art glass is used behind raised glass letters, with a total installation of 156 25-watt, 250-volt lamps, set in troughs of six outlets each, back of the glass, to give uniform distribution. Directional arrows are provided in red and room numbers in green, the names of officials and departments being in clear glass backed by white glass. Apart from its directional usefulness it affords a dignified and effective advertisement of the company to passengers using the elevators of the building.

## Public Utility Good Will Through Public Schools and Libraries

OFFICIALS of the Indiana Public Utility Association have started an educational campaign through the high schools and the public libraries of Indiana. Work now has been started on the compilation of a series of pamphlets which will describe separately the public utilities of the state. The first pamphlet will deal in a general way with the development of public utilities as a whole. The remaining seven will tell more in detail of the various utilities. Each pamphlet will go into the history of the public utility in question, giving data on its growth, and other information regarding its development from the time of the organization of the first plant until the present time.

Letters were sent out recently to 204 public libraries and 128 high schools asking if they cared to put the pamphlets in their institutions. Three days after the letters had been sent eighty-six replies were received from the libraries and fifty-eight from the high schools, and they all were favorable.

# Digest of Electrical Literature

**Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World**

## Generators, Motors and Transformers

*Developments in Conversion Apparatus for Edison Systems.*—T. F. BARTON and T. T. HAMBLETON.—A detailed comparison is made between the characteristics of a field-controlled and a synchronous-booster type of converter as follows: (1) The field-controlled type is said to have higher efficiency. (2) Successful commutation over the voltage and load range of the field-controlled converter is obtained without the use of relays or special rheostats. (3) Better ventilation and accessibility are points in favor of the field-controlled converter. (4) Cost is in favor of field-controlled converter for a voltage range not to exceed 10 per cent (5 per cent above and below). (5) Saving in floor space is in favor of the field-controlled converter. (6) The synchronous-booster converter allows operating at unity power factor at the collector rings over its range of voltage; also it can be designed at additional cost to hold unity power factor at the transformer primary. (7) The synchronous-booster converter can be designed for a large voltage range, while the field-controlled is limited to approximately 10 per cent. (8) When starting from the direct-current side it is not possible to change the alternating voltage of the field-controlled converter for synchronizing, and the direct-current supply should be shifted immediately before closing the alternating-current circuit. This method of synchronizing is desirable on the synchronous-booster converter as well. (9) The field-controlled converter is characterized by simplicity. The synchronous booster may be excited either by direct current in the field coils or by reactive current in the armature. The field winding may therefore be omitted and the field structure somewhat reduced. It is not practicable to furnish as much excitation through the armature as through the field windings, and therefore this type of booster has a smaller voltage range. A type of converter called by the authors "dynarotor" is a machine in which alternating-current and direct-current windings, electrically separate, are placed on one core. The application of motor generator sets to three-wire Edison systems is also discussed, and it is said that converting apparatus lends itself readily to automatic operation. The author suggests that automatic operation might readily be extended on three-wire systems.—*Journal A. I. E. E.*, March, 1921.

## Generation, Transmission and Distribution

*Mechanical Calculation of Overhead Lines.*—There are a great many different methods known for the calculation of the mechanical strength of overhead lines. Most of these methods have been carefully investigated by the French technical commission, and their investigation has resulted in the adoption as standard of the methods and formulas given in this article. Bearing in mind the customary temperature limits, wind pressures and additional forces, a formula is given to determine maximum span and sag. Then follows detailed information for the approved calculation of wooden poles, concrete poles and towers. The section on reinforced-concrete poles is very interesting and complete. Such a collection and adoption of standard methods of calculation, where there is more than one way to reach the result, must be of great help in progressing toward complete standardization.—*Revue Générale de l'Electricité*, March 12, 1921.

*The Frequency Problem in the Steel Industry.*—B. G. LAMME.—The standard frequency of 25 cycles for steel-mill plants was adopted, the author says, many years ago, when the conditions were such that this frequency more nearly met the steel-mill requirements than was possible with 60 cycles. With the coming of large central stations for the general supply of electric service of all kinds the frequency of 60 cycles has come into more general use. In consequence, in considering the purchase of power from the large supply companies, the steel mills are now confronted with the problem of utilizing 60 cycles to best advantage in plants which were initially designed for 25 cycles. Various possibilities for utilization of 60 cycles in such plants are given, and the advantages and disadvantages of each are discussed briefly. It is recognized that the whole matter is too complex and contains too many varied elements to allow an entirely satisfactory general solution.—*Journal A. I. E. E.*, April, 1921.

## Traction

*Economic Aspects of Railway Electrification.*—A. H. ARMSTRONG.—The author considers the electrification of railways from the point of view of a possible remedy for the difficulties now confronting rail transportation.—*Journal of Franklin Institute*, April, 1921.

## Installations, Systems and Appliances

*Regulation of Electric Steel Arc Furnaces Using Movable Electrodes.*—W. G. MYLIUS.—A discussion of the difficulties of operating arc furnaces for melting steel, particularly when melting cold scrap, and of the kinds of arc current regulators which have been devised to maintain some function of the power input constant, such as current, voltage, watts or a combination of these. Difficulties caused by the weight and inertia of the electrodes are considered and the phenomena of "hunting" is explained. A new form of electrode regulator is described and illustrated which will operate with greater precision and at higher speeds than previous types and thus overcome the difficulties of "hunting."—Paper presented before American Electrochemical Society, April 21, 1921.

*Electric Furnaces for Non-Ferrous Alloys.*—H. W. GILLETT.—A tabulation in great detail of all the electric furnaces now in operation in the United States melting non-ferrous metals, giving the kind of furnace, users and capacity per heat. There are 323 in 144 different plants, with a capacity of 193 tons per single heat and

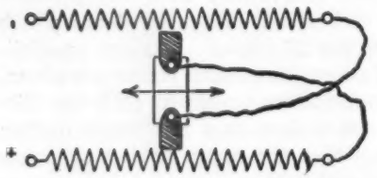
using 42,350 kw. The article also tabulates the composition of the alloys worked in the different furnaces and the special work for which each type of furnace is best adapted and discusses briefly the construction, advantages and disadvantages of each type.—From paper presented before American Electrochemical Society, April 21, 1921.

### Electrochemistry and Batteries

*A New High-Capacity Storage Battery.*—C. W. Hazelett.—Description of a very thin-plate storage battery having about three times the exposed surface per pound of material compared with any other commercial battery. The electrical output per unit weight of lead and active material is 50 to 200 per cent higher than that of the standard types, and it is less subject to mechanical defects and variability. Batteries may be rebuilt by shipping charged elements wrapped in paper, the separators between the plates not allowing them to dry out in transit.—From paper presented before American Electrochemical Society, April 21, 1921.

### Units, Measurements and Instruments

*Resistance Regulators with Saving in Resistance Material.*—R. Richter.—In the usual method of voltage or current regulation by means of variable amounts of resistance cut into the line, parts of the resistance material are cut out or short-circuited, so that some of the material is idle. The ratio of unused to used



RHEOSTAT FOR UTILIZING ALL OF THE RESISTANCE MATERIAL

resistance becomes greater when the limits of regulation become wider. Consequently the heating of the resistance is always localized to a certain portion of all the resistance used in the regulator. The arrangement is, therefore, inefficient. The new method described in this article divides all the available resistance into two or more equal branches, and the contacts are so arranged as to permit of a gradual change from series to parallel connection of these branches, using always in every position of the lever or glider *all* the resistance material. The number of necessary contacts is twice the number in the usual method, but they carry less current. For three-phase regulation a better use of the resistance material may be obtained by arranging the contacts to change gradually from delta to star connection. To still greater advantage this method of regulation may be used for tap connections on transformers or generators by substituting parts of the windings for the resistances.—*Elektrotechnische Zeitschrift*, March 10, 1921.

*Explanations of the Stroboscopic Method of Slip Measurement.*—C. Breitfeld.—This short article explains why in many cases the method of determining the frequency or the percentage slip of a motor which consists in illuminating a sector painted on the shaft of the generator or motor by an arc light fed by the same circuit does not give actual values. Two such cases are mathematically explained. Besides taking certain arithmetical precautions, the author says that it is essential to use in the arc lamp two absolutely identical carbons; otherwise an electric valve action is likely to take place, giving only half the actual value. This is of such great importance that the author suggests using always two halves from one carbon rod.—*Elektrotechnik und Maschinenbau*, Feb. 27, 1921.

### Telegraphy, Telephony and Signals

*Repetition of Signals on Locomotives.*—F. Limon.—A system used by the French State Railways is described which gives the engineer a warning signal and also makes a record of it if he passes a closed semaphore. The transmission is operated by wireless waves emitted from a stationary signal post at the side of the track, which in turn is operated by a rail contact set in conjunction with the semaphore. A short horizontal antenna is installed at the signal post and at the two sides of the locomotive. A small spark coil and gap is used as a wave generator. The detector is of the coherer type.—*L'Electricien*, March 15, 1921.

*New Type of Condenser Antenna.*—S. R. Winters.—The practical use of a condenser antenna is particularly adapted to wave lengths below 400 m. as shown by the radio-communication section of the Bureau of Standards. In some cases the condenser antenna assumes the form of an extensive screen. Directional characteristics of this type of antenna are also discussed.—*Wireless Age*, April, 1921.

*The Lafayette Radio Station.*—S. C. Hooper.—A description of the high-power radio station built by the American Navy Department near Bordeaux, France, and later turned over to the French government. The principal engineering features of the station are eight self-supporting steel towers, each 820 ft. (250 m.) in height, the antenna system and the transmitting equipment consisting of 1,000-kw. arcs complete in duplicate. The Poulsen type of arc equipment is used and the "L" type of antenna, consisting of No. 3 silicon-bronze cable, has been installed.—*Electric Journal*, April, 1921.

*Carrier Current Telephony and Telegraphy.*—E. H. Colpitts and O. B. Blackwell.—This paper briefly outlines the history of the development of carrier multiplex telegraphy and telephony. The fundamental principles underlying particularly the newer developments of the art are then discussed. Consideration is likewise given to the propagation characteristics of open-wire lines, including those containing intermediate lengths of cable. Commercial types of apparatus and actual installations are described and a brief statement is made as to further applications of the art.—*Journal A. I. E. E.*, April and May, 1921.

*The Heterodyne Receiver.*—J. V. L. Hogan.—The heterodyne receiver is said to make use of a local source of energy which is combined with the signal-producing effects of the received electromagnetic waves, which may be amplified for ready interpretation. This system is ascribed to Fassenden and the present development of the device is described.—*Electric Journal*, April, 1921.

*A System of Railway Traffic Control by Telephone.*—T. F. Lee.—The author deals particularly with the control of freight traffic, asserting that the telegraph control at one time almost universally employed is gradually giving way to various control systems depending on telephones. He says that especially efficient instruments and various forms of signaling from one instrument to another have been developed for this purpose. These instruments are described in the article.—London *Electrician*, April 1, 1921.

# Books of Technical and Industrial Interest

DAS KUGELPHOTOMETER. By Richard Ulbricht. 110 pages, 34 illustrations. Munich: R. Oldenburg.

This book gives a full historical account of the development of the use of the hollow-sphere photometer, together with complete mathematical derivations of formulas used for measuring light intensities with such apparatus. The author, being the inventor of the widely used sphere photometer, was honored by the V. D. E. in that his name has been linked with the method he devised, standardized for all light measurements on arc lamps in 1907 ("Ulbricht'sche Kugel"). In ten chapters the subject has been covered very thoroughly. Detailed directions are given on the proper painting of the interior of these spheres, based upon mathematical conclusions and practical experience.

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THE STANDARD ELECTRICAL DICTIONARY. By T. O'Conor Sloane. New York: Norman W. Henley Publishing Company. 768 pages, 477 illustrations.

This is a new and enlarged edition of a well-known electrical dictionary. A new section has been added in alphabetical order, so that the reader who does not find the term he seeks in the main section can often find it in the added section. This plan has enabled the volume to be enlarged without recasting all the original material, a great economical advantage in these days of heavy printing costs. The total number of words and terms defined in the book is about 4,000. A large amount of work must have been expended in their accumulation. There are two kinds of electrical dictionaries; namely, those adapted to the needs of technical readers and those adapted to the needs of non-technical readers. This book belongs mainly to the second kind. It will, however, be of service to the electrical public as well as to the general public.

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READINGS AND PROBLEMS IN STATISTICAL METHODS. By Horace Secrist, Ph.D. New York: Macmillan Company. 427 pages.

An interesting and useful volume written by a real authority on the subject. Intended primarily as a textbook and laboratory assistant, it presents the various statistical methods in a simple manner, rendering the work suitable for general use as well as for the classroom. The book was written to be used in conjunction with the author's "Introduction to Statistical Methods," but either of these volumes may be used separately or for general purposes. The first portion of the book is an interesting explanation of the meaning and application of statistics and statistical methods. The explanations are entirely practical and drawn from busy industrial life. Following this is a study in the collection of statistical data. The discussion of questionnaires and points to be considered in their use is especially applicable to the electrical industry. If every questionnaire sent to this industry were studied carefully in accordance with the directions given in this book, valuable data would be gained at a minimum of time and expense. Tabulation and analysis of the collected data take up the third portion of the book. The last 100 pages consist of an almost entirely theoretical discussion of averages, dispersion, "skewness" and correlation. Perhaps one of the most appreciated additions to the volume, from the standpoint of the laboratory instructor, is the list of review questions and problems which concludes each chapter.

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SPACE AND TIME IN CONTEMPORARY PHYSICS. By Moritz Schlick. New York: Oxford University Press. 88 pages.

This is a good translation of a well-known book on the Einstein theory, written from the philosophic viewpoint. The author supports Einstein in the proposition that the world is a four-dimensional space-time manifold, and that the geometry of this world is non-Euclidian. He goes on to present the doctrine that force has no real existence in our world. In particular, there is no such real thing as gravitational force. Bodies only appear to be attracted toward the center of the earth and toward one another. They really are moving freely in distorted or non-Euclidian space, and it is the distortions of the space in the neighborhood of matter which give rise to the observed gravitational phenomena. Moreover, space is not infinite but is limited in a specific manner, the volume of the total world space being a very large definite number of cubic centimeters. This Einstein doctrine is presented in a very plausible manner. From a purely mathematical standpoint it has much to recommend it. From a philosophical standpoint it has also many advantages. From an engineering standpoint it offers many difficulties in the way of realization. Yet one has no right to deny a hypothesis merely because it is difficult to visualize. The book presents the arguments of a mathematical hypothesis with the minimum amount of mathematical symbols.

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ENGINEERING ELECTRICITY. By Ralph G. Hudson. New York: John Wiley & Sons, Inc. 190 pages, 288 illustrations.

An excellent elementary textbook of electrical engineering, particularly with reference to the generation and distribution of power by electricity. The book has been prepared primarily for technical students not specializing in electrical engineering, but it may also serve as an introductory text for electrical engineering students. The illustrations are mostly diagrammatic. The illustrations of apparatus and machinery are grouped together at the end—a somewhat novel procedure which has certain advantages. The mathematical treatment is of the engineers' type. That is to say, elementary calculus is utilized as a descriptive device only. The excellent rule is followed of having the unit in which each equation is expressed written along with and immediately after the equation. This makes the formulas much more easily grasped. The work is divided into seventeen chapters on the following subjects: Direct-current circuits, electromagnetism, electromagnetic induction, the direct-current dynamo, direct-current measurements, alternating-current circuits, alternating-current measurements, three-phase alternating currents, the alternating-current transmission line, the synchronous generator, the synchronous motor, the synchronous converter, the mercury-arc rectifier, the transformer, the three-phase induction motor, the alternating-current series commutator motor, illustrations of electrical apparatus and tables. The treatment is clear and logical, and a good index completes the book.

# News of the Industry

**Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions**

## Convention Plans Rapidly Nearing Completion

PLANS for the National Electric Light Association convention are rapidly shaping up. A large number of papers and reports are now in the hands of the printers and already quite a few have been printed. Some of the reports this year are very voluminous, especially the report of the committee on prime movers, which will probably exceed 400 printed pages.

Some places in the program which appeared in last week's issue of the ELECTRICAL WORLD, page 1065, not then definitely arranged for have been filled. It was announced this week that James A. Perry, president of the National Association of Railway and Public Utility Commissioners, and E. I. Lewis, newly appointed member of the Interstate Commerce Commission and formerly of the Indiana Public Service Commission, would deliver addresses on topics of their own choosing at the general sessions.

## Some Large Financing by Electric Utilities the Past Week

DURING the past week three electric light and power utilities did some very large financing.

The Philadelphia Electric Company disposed of the unsubscribed balance of a five-million-dollar issue of 8 per cent preferred stock at par.

The Connecticut Light & Power Company brought out $6,500,000 of first and refunding mortgage 7 per cent sinking-fund gold bonds, series A, and due in thirty years, at 95, yielding 7.4 per cent.

Approximately 8 per cent is the yield on the five-million-dollar issue of the Milwaukee Electric Railway & Light Company twenty-year 7½ per cent refunding and first mortgage gold bonds, series A, which came out this week.

## Utah Supreme Court Denies Rehearing in Special Contract Case

THE Supreme Court of Utah has denied the application of the Utah Copper Company and seventeen other large users of electric power for a rehearing in connection with its decision on Feb. 25 sustaining the Public Utilities Commission of Utah in the special contract case, whereby all existing special power contracts of the Utah Power & Light Company customers in Utah were declared discriminatory and ordered placed on standard schedules. The case was appealed to the Supreme Court by the consumers on the ground that the commision had no authority to change any of the terms of the contracts because they were entered into prior to the creation of the commission.

In denying the rehearing the court made it plain that it was not deciding as to the fairness of the rates, but as to the right of the commission to change the terms of existing contracts. The denial of the rehearing leaves the way open for appeal to the United States Supreme Court.

The Supreme Court of the state has issued to the Utah Copper Company a writ of review of the proceedings of the commission leading to the increase of the power schedules of the Utah Power & Light Company. The Utah Copper Company is the power company's largest consumer. It is expected that other large consumers of power will also join in the proceedings.

## Exemption of Utility Securities from Federal Taxation Urged

PROHIBITION of the issuance of tax-exempt government issues so as to enable regulated industries to dispose of their securities and raise badly needed money was declared vital to the lives of public utilities by Philip H. Gadsden of Philadelphia in a statement on revision of federal tax laws made last Tuesday before the Senate finance committee. Mr. Gadsden appeared as chairman of the joint tax committee representing the American Electric Railway Association, the American Gas Association and the National Electric Light Association. He declared emphatically that public utilities do not seek to evade taxation but merely desire better conditions under which to market their securities that they may be able to provide badly needed extensions and betterments for their properties.

Since public utilities are regulated as to operation as a class and compelled to give service at fixed prices regardless of economic conditions it is only fair, he declared, that they be considered as a separate class in legislation governing taxation. He urged the appointment of a special sub-committee to make a thorough study of the public utility tax situation.

Two features of the securities situation on which Mr. Gadsden laid especial emphasis are that persons upon whom public utilities must depend very largely for new money—those subject to a surtax of over 3 per cent—no longer will buy public utility securities because they find tax-exempt 5 per cent government securities better investments.

Moreover, the only persons who under the present tax laws find it profitable to buy public utility securities are those whose incomes are less than $10,000 a year. Their combined savings are only $116,000,000, or about $1,884,000,000 less than is required annually by the public utilities, including steam railroads, electric railways, gas, electric light and power plants to make their betterments and extensions.

"The most serious question which confronts public utilities," Mr. Gadsden said, "is their inability to secure the necessary new capital required by them annually in competition with tax-exempt municipal securities. Owing to the high income tax and surtaxes an anomalous situation has been brought about where a municipal bond bearing 5 per cent will yield a greater

return to the investor than a public utility security would pay. It can be shown that a taxpayer or an investor who pays a surtax of over 3 per cent cannot afford to invest his money in public utility securities in preference to municipal securities. In other words, only that class of investors in this country who have an income not exceeding $10,000 can under our present tax laws afford to invest their savings in public utility securities.

"Under the law public utilities are limited to a return on their investment of not over 8 per cent. It is clear, therefore, that they cannot issue securities agreeing to pay more than that amount for any long time. Unless they can pay over 8 per cent they cannot compete with exempt municipal and state securities. The result of this situation is that inevitably these extensions and betterments cannot be made. Service would slow down and become unsatisfactory and there would be a growing demand on the part of the public for the acquisition of these utilities by municipalities on the ground that they could borrow money at not over 5 per cent. In other words, while the political policy of this country is firmly and definitely opposed to municipal and government ownership of utilities the taxation policies of our government are forcing it whether we want it or not. Unless this policy of exempting municipal securities is discontinued we shall rapidly drift into practical socialism, which in its essence means ownership of everything by the public.

"Now, what is the answer? The answer is that, first, we should follow the advice of Secretary Mellon in his recent letter to the chairman of the ways and means committee and forbid the issuance of any more tax-exempt securities by anybody."

## Arkansas Utilities Men Consider Education of Customers and Efficient Combustion

ADOPTION of methods to familiarize the public with the plans and the operating routine of the utilities serving it was advocated before the opening session of the Arkansas Utilities Association at Hot Springs, Ark., on Wednesday, by J. E. Farnsworth, vice-president of the Southwestern Bell Telephone Company, who declared this to be one of the best tools that can be used in a campaign of education. He asserted that the old idea that courtesy costs nothing was an error and that the motto of "Never do something for nothing" was a serious mistake. Courtesy costs time and effort and in many cases direct expenditure of money, while the items of service that bring no direct return in money are an important part of the work of every utility. Both are duties that every utility owes to the public that it serves, and the effort is paid for in public good will that means more than money returns. Mr. Farnsworth said that the training of a few individuals in an organization in public relations methods was not sufficient. Some way of passing the specialized knowledge of the few through the entire organization must be developed. Employees must be educated in the essentials of the business to impart to them an interest that cannot be expected if they know only their own particular job. Disloyal employees must not be tolerated. Supervising employees must keep in close touch with public officials and take part in all public activities.

W. G. Shurgar of Little Rock discussed efficient fuel combustion, placing the responsibility for inefficient use on the manager of the plant, the superintendent and the fireman. The manager is to blame for not seeing that efficiently designed plants are supplied and then for not insisting that efficient operation is insured. The superintendent is responsible for not knowing all possible sources of waste and for the lack of constant checking to know that waste is being prevented. Intelligent men must be obtained for the firing force, because the work is not common labor but a chemical operation requiring intelligence to carry out. Items of loss can be audited, and Mr. Shurgar urged the establishment and careful maintenance of detailed records that would reveal the wastes that occur. Discussion brought out the importance of keeping boilers clean and all equipment in first-class condition.

The convention continued through Thursday, and on Friday and Saturday the association joined the first annual convention of the southwestern Geographic Division of the National Electric Light Association, of which the Arkansas association is a part.

## Co-operative Municipal Development of Water Powers Voted Down

THE California Legislature has killed a bill which was intended to permit municipalities to band together in the development of hydro-electric power. This privilege was desired by several groups of California cities which wished to join together and develop some of the available water-power sites in the high Sierras and distribute the power among the cities contributing to the financing.

Although this bill has been defeated at this time, there is every likelihood that it will again be called up as there are many municipalities in California officials of which are anxious to undertake municipal ownership of the local power systems. The proponents of this measure have pointed as an example to the city of Los Angeles, which has already developed some power sites and which is active in plans for further developments, particularly on the Colorado River.

## Jobbers' Hot Springs Program of Broad Nature

ARRANGEMENTS for the annual convention of the Electrical Supply Jobbers' Association at Hot Springs, Va., have been completed. An interesting program has been prepared and includes the following papers of broad interest: "Co-operative Methods in Upbuilding the Industry," by M. H. Aylesworth, executive manager National Electric Light Association; "Looking Forward," by W. L. Goodwin, assistant to the president of the Society for Electrical Development; "Does the Electrical Jobber Have Any Responsibility in the Safety Movement?" by Andrew MacLachlan, secretary of the Square D Company; "Co-operation," by Herman Plaut, representing the Illuminating Engineering Society; "The Straight Path," by Samuel A. Chase of the Westinghouse Electric & Manufacturing Company, and "The Romance of Niagara's Electric Power," by George S. Anderson of the publicity department of the Niagara Falls Hydro-Electric Development Company.

An open meeting will be held May 25 and meetings of the various divisions and a general meeting will be held on the following days. On May 27 there will be held a general meeting at which the work of the association will be discussed.

## Units for Wire and Cable Literature

WITHOUT attempting to standardize, the sub-committee on wires and cables of the A. I. E. E. standards committee has taken a vote of its members to show their preference in the matter of units used in wire and cable literature. The sub-committee was of the opinion that it would be undesirable to attempt to standardize in such a matter on the basis of opinions expressed by its members only and thought it would be better to extend the inquiry before coming to a decision. The result of the ballot is as follows:

Metric units should be used for thermal properties and dielectric stresses as follows:

| Temperature | C° |
|---|---|
| Heat resistivity | C° per watt-cm.³ |
| Heat conductivity | Watts-cm.³ per C° |
| Heat resistance | C° per watt-cm. |
| Heat conductance | Watt-cm. per C° |
| Dielectric stress | Kilovolts per cm. |

The thickness of insulation should be expressed in sixty-fourths of an inch.

Dielectric losses should be expressed in watts per foot.

The megohms and capacity constants should be based upon 1,000 ft.

Mechanical properties such as tensile strength and elongation should be expressed in pounds and inches.

## More Changes in California Railroad Commission

THE resignation of F. R. Devlin as president of the California Railroad Commission has been announced and became effective May 1. To replace Mr. Devlin the Governor has appointed H. S. Benedict, at present a member of the State Board of Control. The chief hydraulic engineer of the commission, C. H. Loveland, also tendered his resignation, which took effect May 1. With these changes the personnel of the commission will be materially different from that of last year, as on Jan. 1 C. H. Powell was appointed to take the place of President E. O. Edgerton and during the last two months G. S. Jacobs, assistant chief engineer, also resigned.

Mr. Devlin had been president of the California Commission since the retirement of Mr. Edgerton and had been a member of the commission for six years. He has retired to resume the practice of law. Mr. Loveland had been with the commission for the last seven years and during that time was active in matters relating to domestic water and irrigation projects. He will enter private practice as a consulting engineer in projects involving the development of the state water resources.

## Very Little of Idaho Power Possibilities Developed

NINETY-FOUR per cent of the undeveloped water power of the State of Idaho is controlled by the federal government through its ownership of lands which will be affected by its development, according to a statement recently made by W. R. Putnam, vice-president and general manager of the Idaho Power Company. Mr. Putnam said that Idaho has a potential water power of 6,110,000 hp., of which approximately only 100,000 hp., or 1.6 per cent, has been developed.

"Almost all of the developed hydro power in Idaho has been developed in the southern part of the state," he said. "In that portion of southern Idaho starting at American Falls on the east and extending to the northwest corner of the state, where the Snake River leaves the state, there has been developed 66,700 hp. The ultimate capacity of the power developments that can be made on the Snake River between these two points is in excess of 400,000 and probably amounts to 500,000 hp., so that about 15 per cent of the total power in this immediate territory that can be developed is now developed and utilized.

"The use of hydro power in this portion of Idaho doubled in the three years from 1907 to 1910. It again doubled from 1910 to 1915, and has doubled once more in the years since 1915, and a careful study indicates that the normal use of power in this territory will again double in the next nine years, and that at the end of that period there will be approximately 70 per cent of the total power possibilities of this immediate territory unused."

## Steel-Mill Power Costs Distributed on Machine-Hour Basis

ELECTRIC power costs are distributed on a machine-hour basis at the plant of the Tioga Steel Company, according to a statement made by W. H. Boyce in a discussion of "Power Distribution in Industrial Plants" at the May 7 meeting of the Philadelphia Section, Association of Iron and Steel Electrical Engineers. Departmental requirements are metered, and the distribution is arrived at by taking the connected horsepower for each department, and with the running hours as a basis the final percentages of the consumption are figured.

Records of motor failures classified and checked against departments have been found helpful in maintaining departmental electrical efficiency, R. B. Gerhardt, Bethlehem Steel Company, asserted in his discussion of record forms.

Other subjects which were discussed at the meeting were: "Resistance Materials," by Walter Kennedy, Worth Steel Company, and "Dynamic Braking for Crane Motors," by G. W. Richardson, American Bridge Company.

Officers elected for the coming year were G. H. Schaeffer, Carpenter Steel Company, chairman, and W. C. Kennedy, vice-chairman. This meeting was the last technical session of the Philadelphia Section until fall. The annual outing will take place on June 4 at Valley Forge.

## Comprehensive Foreign Trade Program Urged

EVERY phase of the world's export business is covered in the foreign trade program unanimously adopted last week at Cleveland at the close of the eighth annual convention of the National Foreign Trade Council. Copies of the program were sent to President Harding, members of his Cabinet, senators and representatives.

Credits, exchange rates, taxation, tariffs, the merchant marine, domestic transportation, consular service, parcel post and numerous other things are discussed in the program, which is really a composite of all of the recommendations of the four days of the convention.

The United States is a creditor nation and must import heavily, the program declares. There must be

created adequate facilities for drawing upon surplus American investments in order to furnish long-term credits. The creation of financial institutions under the Edge law to facilitate extension of long-term credits is urged.

Substantial reductions in the cost of living are declared to be essential if production costs are to decrease to the point where American goods may again compete in price with foreign goods.

The program voices its appreciation of the work of trade publications and the daily press in the dissemination of accurate foreign news.

## Colorado Federal Court Insists that Public Does Not Own Utilities

WHAT might be regarded perhaps as an ultra-conservative view of the property rights of public utilities as opposed to the view that they are the creatures of the public, which may bend them to its will, was taken by the United States Court of the District of Colorado in a recent decision by which it granted to the Denver Tramway Company an 8-cent fare, or 2 cents more than the fare allowed by city ordinance, and enjoined the municipal authorities from interfering with the collection of the higher rate.

"The property that is in these street-car lines, electric light plants, telephone systems and other utilities is as much the property of the stockholders as a man's house is his property, and the public has got to leave it alone. They must treat it fairly and the courts are here to see that they do," the court said. "The public doesn't own that property any more than I own your coat. The only right and power it has over the companies is to regulate the rates after they are authorized to do business, and in that regulation the public has got to act judicially and fairly and allow the public utility a fair return on its investment.

"We have got to get away from this idea that has been planted in the public mind that because there is a street-car system in our town or an electric light system the public can take it and use it just as it pleases. It is pure destruction; it is anarchy; it is an utter disregard of the rights of property, and this government cannot continue on the cultivation of any such fundamental error in the minds of the people."

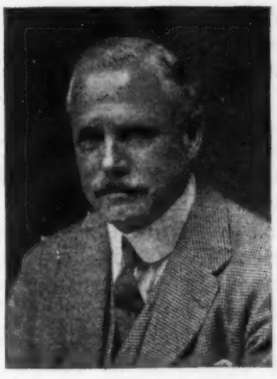
## Illinois Commission Bill Before Legislature

AN INCREASE in membership and an increase in salaries are two of the important developments in the Illinois Public Utility Commission situation. These developments became known when the main features of the administration bill to carry out Governor Small's campaign pledges were recently made public. The title of the commission under this bill would become the "Illinois Commerce Commission," and the body would consist of seven members as against the present five. Salaries would be $7,000 per year.

The commission would be forbidden to abrogate franchise agreements between a municipality and a utility if such agreements were made as a consideration for the franchise. Standards of service would be fixed, and in case of failure to meet such standards utility rates could be fixed on the quality of service furnished.

At any general election, on petition of 5 per cent of the voters, the question of home rule could be submitted and carried by a majority of the total vote cast at the election. A majority of those voting on the subject would not carry the proposition. City authority would supersede the commission on the adoption of home rule except as to reports and accounts and as to financial transactions. If home rule is rejected it cannot be resubmitted in less than two years, and when a city has surrendered home rule it cannot be resumed in less than two years. A municipality adopting home rule can obtain the aid of the commission, and in disagreements upon matters of regulation the parties are authorized by agreement to submit the dispute to the state commission in place of the courts.

## J. M. Wakeman Resigns from Society for Electrical Development



J. M. WAKEMAN

ANNOUNCEMENT is made by W.W. Freeman, president of the Society for Electrical Development, that at a meeting of the board of directors of the society held in New York on May 10 James M. Wakeman tendered his resignation as general manager of the society, which was accepted, effective as of Sept. 1, with leave of absence granted from June 1. Mr. Wakeman has served as general manager of the society from the commencement of its activities and has rendered most valuable services to the society and the industry in that capacity.

The directors of the society are unanimous in their expression of regret that Mr. Wakeman finds it necessary to withdraw from the executive direction of the society's activities, and their heartiest wishes will follow him into his future field of effort. A committee was appointed to draw up a suitable resolution to express the appreciation of the directors.

The resolution which the committee drew, and which was passed unanimously, reads as follows:

"The board of directors of the Society for Electrical Development, in accepting the resignation of James M. Wakeman, its general manager from the date of its organization, desires to enter on the minutes its full recognition and appreciation of the very valuable, comprehensive and enthusiastic work given by him to the society. Mr. Wakeman has been constant and industrious in his efforts and has won for himself not only the sincere commendation of the board as a whole for the conscientious and able performance of his duties, but is entitled to and receives the personal respect, esteem and good wishes of every member. The standing and influence of the society today are to be largely attributed to the splendid and faithful efforts of Mr. Wakeman, and the directors of the society take pleasure in so stating as part of the minutes of this meeting."

Effective June 1, William L. Goodwin, assistant to the president, will assume charge of both the office and field activities of the society.

## Sprague to Receive Franklin Medal

FRANK J. SPRAGUE, pioneer in the field of electric traction, has been selected as this year's medalist by the Franklin Institute. Presentation of the Franklin medal will take place in Philadelphia the afternoon of May 18, at which time Mr. Sprague will read a paper entitled "Electric Traction—A Review." The other Franklin medalist this year is Prof. Charles Fabry of the University of Paris, France. His paper is entitled "Studies in the Field of Light Radiation."

Both Mr. Sprague and Prof. Fabry, together with General Pershing, will receive at the same time certificates of honorary membership into the institute.

## New England Central-Station Men Cheer Industrial Heating Lecturers

ROUSING cheers welcomed the manufacturers' representatives who journeyed to Boston this week to conduct an industrial electric heating course at the Engineers' Club, under the auspices of the power division of the New England Division of the N. E. L. A. The group of meetings was opened on Tuesday morning, May 10, by V. M. F. Tallman, chairman of the Commercial Section of the New England Division, and John West, chairman of the power division, presided. The idea of the course is the outgrowth of the recommendations of the power division at the Kineo convention last fall. New England central-station companies, with few exceptions, have felt a need for more comprehensive knowledge of the development and applications of industrial electric heating apparatus in competition with other methods. The Boston meetings aim to bring before power engineers and others interested the latest information available upon the design, application and results of installation of this class of apparatus. Later it is hoped that many New England utilities will send representatives to manufacturing plants to continue the instruction begun at Boston. The sessions were conducted by some of the foremost electric heating experts in the country. The following manufacturers' representatives were scheduled to preside over the various sessions: E. N. Lightfoot, engineering manager industrial heating department, Cutler-Hammer Manufacturing Company, New York; Wirt S. Scott, manager industrial heating section, Westinghouse Electric & Manufacturing Company, Mansfield, Ohio; Harold Fulwider, manager department of industrial heating sales, General Electric Company, Schenectady, N. Y.; Henry Gieseke, engineer electric furnace department, Ajax Metal Company, Philadelphia, and F. D. Goode, sales manager Electric Boiler Corporation, Cambridge, Mass. More than sixty attended the opening session.

## Swiss Railway Electrification Making Fast Progress

THE Swiss Federal Council, according to advices from the ELECTRICAL WORLD'S Swiss correspondent, has recently appropriated 100,000,000 francs for further electrification of the federal railways. The federal authorities have also been asked to grant a concession for the construction of a huge hydro-electric plant at Andermett-Wassen, including a storage lake of 250,000,000 cu.m. capacity, which would permit the development of at least 200,000 hp.

Early in April the first trial trains of the St. Gotthard electrification were run on the mountainous section from Biasca to Bellinzona, the energy being supplied by a single group of machinery in the Riton works, where three turbine-generators are alternately used. The large power station at Amsteg has been completed and the machinery is being installed. By the end of the year the entire plant will be ready. The mild winter facilitated the work of electrification, and it is expected that the whole section from Bellinzona to Lugano and Chiasso will be ready for electric traffic by the end of October. By that time also the double-track line from Giubasco to Sasso will be completed, so that by the end of the present year the entire line from Arth-Goldau to Chiasso, the Italian frontier station, about 200 km. in length, will be operated by electricity.

The total length of railways in Switzerland electrified from the beginning of 1918 up to the end of 1920 comprised 280 km. of state railways equipped with single-phase alternating current and 68 km. equipped for three-phase alternating current; the Berne-Dehrets railways, of which 113 km. is equipped for single-phase alternating current and 22 km. for three-phase alternating current, and the Rhaetic railways, 122 km. in length, employing single-phase current. On the Rhaetic railways eight trains are now running daily from Landquart to Thusis and six from Landquart to Chur.

## Dollar Charge for First Kilowatt-Hour Disallowed

A CHARGE of $1 for the first kilowatt-hour per month in the lighting rates of the Amesbury Electric Light Company has been disapproved by the Massachusetts Department of Public Utilities in a decision following an appeal of the selectmen and others against the company. In November, 1920, the company put into effect a schedule of rates starting with $1 net for the first kilowatt-hour per month used in commercial lighting installations and ranging from 15 cents per kilowatt-hour between 1 kw.-hr. and 20 kw.-hr. to 12 cents net above 61 kw.-hr. per month, with a minimum charge of 75 cents per month. Pleading the need of increased income, the company held that a uniform increase in the prices per kilowatt-hour would be inequitable as between the lighting customers, on account of expenses attributable to the number of customers supplied rather than to their respective energy consumption. When the company established the initial rate of $1 the commission holds that it confounded the so-called "customer" and "demand" factors in allocating expenses. The commission is of the opinion that the present initial dollar charge should be discontinued and that it is not necessary or expedient to modify it so that it shall include only the "customer" charge. In recommending a rearrangement of the schedule for trial without prejudice the commission recognizes the possibility of a reopening of the rate question for the consideration among other things of a "service" charge. It is ordered that beginning June 1 the lighting schedule shall be, net, 16 cents per kilowatt-hour for the first 40 kw.-hr. per month, 14 cents per kilowatt-hour for the next 40-kw.-hr., and for all in excess of 80 kw.-hr. 12 cents. A minimum charge of 75 cents per month is permitted.

An interesting feature of the case was the company's method of establishing the initial rate. It did this by taking all operating expenses of the last fiscal year

save the cost of energy purchased and of maintaining and renewing street lamps, together with an allowance for depreciation of lines, transformers and meters, less rentals of lines and equipment, and apportioning this sum as between lighting and power customers in proportion to the feet of wire in the circuits serving each group. The cost apportioned to the lighting customers was then divided by the number of such customers and the quotient by twelve, with the result of $1.05. This, with the cost of the energy supplied, the company assumed to be the cost to it of the first kilowatt-hour delivered to each lighting customer a month. The commission, however, expressed its lack of conviction of the reasonableness of this method of allocation.

## Municipal Plant Withdraws from Motor Merchandising

ANNOUNCEMENT is made by Commissioner Ira S. Davisson of the Tacoma (Wash.) municipal light department that the department will withdraw from the business of selling and renting motors. The motor business has been profitable, making a return of about 12 per cent, but Commissioner Davisson declares that the local electric dealers' ability to care for the demand for motors and their willingness to co-operate with the city in the promotion of business make it advisable for the city to discontinue the service. The city has $49,000 invested in motors now out on rental and has $12,000 worth of motors in stock. The sale of electric ranges and light globes will be continued, but the light department is considering the discontinuance of free lamps to commercial customers.

## No Immediate Reduction of Interest Rates Looked For by Bankers

THAT liquidation has not yet proceeded to a point that will make possible a reduction of interest rates during 1921, or at least before the end of the year is near, was one of the opinions expressed by John S. Drum, president of the American Bankers' Association, in presenting at a session of the executive council of this body held in Pinehurst, N. C., recently the results of an economic survey made by the association.

Mr. Drum said that the survey "has shown that the great economic problems that confront us today fall into two broad classes, which may be expressed in the terms of the problems of production and those of costs and markets." Commenting upon the extent to which readjustment from war conditions has been accomplished he said: "The weight of opinion is that this readjustment, this tendency toward stabilization, will not be accomplished in the year or the two years that lie just ahead of us."

On the labor situation Mr. Drum asserted that "the survey shows that notable exceptions to the tendency toward wage reduction are apparent in the building trades and among railway employees. Many replies point out that the wages of railway employees and men engaged in the building trades will be reduced when there is a realization that it is not wages per day but wages per year that count."

After discussing the question of cancellation Mr. Drum said: "Summing up, majority opinion is that of the four principal problems affecting domestic markets those involving cancellation and the inclination to hold goods and raw materials rather than to take losses, while still serious, are moving toward solution." He went on to discuss the views elicited by the questionnaire in regard to foreign trade and the necessity of the United States helping Europe and other foreign countries to buy if business is to go forward in a normal way in those countries and if the United States is to have a larger market for its products.

## One-tenth of Ohio's Population Interested in Utility Securities

HOW widespread the ownership of public utility securities is becoming may be judged from a report of the Ohio Committee on Public Utility Information made public recently. According to the report there are slightly more than 112,000 Ohioans who own public utility securities. Considering the families and dependents of these 112,000 investors, this means that close to one-tenth of the population of Ohio is financially interested in the progress, development and protection of the state's public utility companies.

There are 23,000 Ohioans who are owners of electrical securities. The savings of 42,000 residents of the state are invested in telephone securities; 22,000 have invested in the gas industry, 20,000 in electric traction and 900 in water companies.

## French and American Colleges to Exchange Technical Professors

AS THE result largely of the initiatory efforts of the late Dr. R. C. Maclaurin, president of the Massachusetts Institute of Technology, an arrangement has been made by a committee representing Columbia, Cornell, Harvard, Johns Hopkins, Pennsylvania and Yale Universities and the Massachusetts "Tech" to "exchange" technical professors with the French University Administration in the same manner that professors of literature, history, law and other subjects have for years been exchanged. Dr. A. E. Kennelly, professor of electrical engineering at Harvard and the Massachusetts Institute of Technology, has been selected as the first American representative and will lecture before French schools in the coming school year. The first representative of France will be Prof. J. Cavalier, rector of the University of Toulouse.

The president of the American university committee having this matter in charge is Director Russell H. Chittenden of Yale, and the secretary is Dean J. B. Whitehead of Johns Hopkins.

## Engineering Council Appeals for Support of Pending Patent Legislation

RESIGNATIONS in large numbers are crippling the United States Patent Office to the point of disorganization and are creating conditions that threaten American industrial enterprise and invention, according to a statement issued this week by the American Engineering Council of the Federated American Engineering Societies. The council appealed for support of pending patent legislation which provides increases in salaries to check the exodus of employees from the Patent Office to private employment. In a little more than one year, it was stated, 110 of the force of examiners, numbering 437, have resigned. During the first three weeks of the Harding administration six highly trained experts left to accept salaries two or three times as great.

## "Uniform System of Accounts for Electrical Corporations" Ready

THE "Uniform System of Accounts for Corporations," prepared by the committee on statistics and accounts of public utilities of the National Association of Railway and Utilities Commissioners and recommended for adoption by state commissioners at the annual meeting of the association held at Washington in November, 1920, has been printed in a revised edition and is ready for distribution. This edition contains an appendix explanatory of the amendments and modifications to the uniform system that have been made by the National Electric Light Association.

## English Interests Finish 100,000-Hp. High-Head Plant in Spain

ACCORDING to G. W. Caldwell of San Antonio, Tex., chief engineer of the Ebro Irrigation & Power Company, Ltd., that corporation has just finished the construction of the first unit of a great hydro-electric plant in the province of Catalina, Spain, about 100 miles from Barcelona. By means of a dam 804 ft. high waters of the Noguera Ballaresa River have been harnessed. The company is composed of the same British interests that constructed and operate the great hydro-electric plant of Necaxa, Mexico, of which Dr. F. S. Pearson of New York, who lost his life in the sinking of the Lusitania, was the head.

The most modern hydraulic and electrical equipment has been installed, and the 100,000 hp. now developed at this station is taken to Barcelona and its adjoining industrial district over 110,000-volt transmission lines. The power development is the fourth of the hydro-electric projects of the Ebro Irrigation & Power Company in Spain. The storage reservoir is 30 miles or more long, and the project is to have an ultimate capacity of 200,000 hp.

## Kansas City to Have Record Automatic Substation System

WHAT is asserted by the manufacturers to be the largest system of automatic stations on record will soon be put in operation in Kansas City, Mo., by the Kansas City Light & Power Company. The entire Edison system of the city is to be controlled from a series of five automatic stations, each containing two synchronous converters operating independently. The automatic switching equipment and the machines are to be furnished by the General Electric Company.

These five substations will be all fed from a central steam generating plant through a network of radial feeders. The capacity of the generating station at present is 60,000 kw., but the ultimate capacity is expected to be more than 150,000 kw. The Edison system will have an approximate capacity of 15,000 kw.

The supply will enter each station at 13,200 volts, 60 cycles, three-phase, and will be converted to direct current by two machines in each station. Of the ten machines eight are rated at 250 volts, 6,000 amp., the other two being rated at 250 volts, 9,000 amp. Each machine will be equipped with an automatic switching equipment, so that in case the line normally feeding it fails for any cause power is immediately fed to it from another line. On return to normal conditions the machine is automatically switched back.

## Safety Engineers to Discuss Safeguards for Electrical Hazards

ELECTRICAL hazards and their safeguards are the topic for discussion at the May 27 meeting of the American Society of Safety Engineers, to be held at the Engineering Societies Building, New York. Three papers, two of which will be illustrated with lantern slides, will be presented. The papers are:

"High-Tension Electric Generation and Transmission," by C. O. Van Dannenberg and W. W. Samuels, electrical engineers the J. G. White Engineering Corporation.

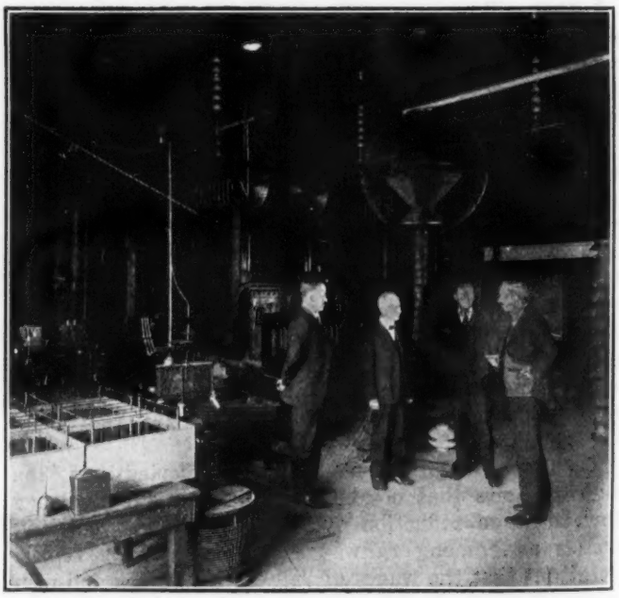
"Electrical Hazards of Terminal Equipment of the New York Central Railroad Entering New York City," by H. S. Balliet, assistant terminal manager Grand Central Station.

"Small-Motor Problems and Industrial Control," by L. E. Smith, General Electric Company.

## New Hampshire Commission Reduces Plymouth Company Rates

FOLLOWING reductions in the price of fuel and acting upon its own initiative the New Hampshire Public Service Commission has ordered a reduction in the maximum rate of the Plymouth Electric Light Company from 20 to 18 cents per kilowatt-hour. During the war the commission authorized the company to charge a maximum of 25 cents per kilowatt-hour, based on coal at about $17 per ton, and recently a reduction to 20 cents was made. The present price is related to a fuel cost of about $10 per ton. The minimum charge has been reduced from $2 to $1.50 per month.

## Where 220 000-Volt Transmission Problems Were Solved



JUST a corner of Prof. Harris J. Ryan's high-tension laboratory at Leland Stanford Junior University, where was solved the insulator and other problems of 220,000-volt transmission. During April the N. E. L. A. 220,000-volt transmission committee worked here, four of whom were photographed. They are, reading left to right, R. Wilkins, Pacific Gas & Electric Company; Prof. Ryan and H. Michener, and R. J. C. Wood. Southern California Edison Company.

# Current News and Notes

**Timely items on electrical happenings throughout the world, together with brief notes of general interest.**

**Wireless Telephony in Great Britain.**—The first installation of wireless telephony for commercial purposes in the United Kingdom was put into operation at Liverpool recently between the head offices of the Mersey Docks and Harbor Board and the Mersey Bar lightship, 12 miles away.

**Spreading Information on the Utilities.**—The Indiana Public Utility Association has got out a special bulletin, entitled "A Half-Century Miracle," which gives data on the public utilities of the state for the purpose of debates, lessons in oral English and current-topics classes.

**New Mexican Commission's Enlarged Scope.**—The State Corporation Commission of New Mexico should no longer be numbered with the bodies which have no jurisdiction over electric light and power companies, an act passed by the Legislature at its last session having given to it a certain degree of control over public utilities.

**Lighting New York's Town Hall.**—The new Town Hall of New York City, a civic auditorium held in trust for the citizens, is lighted as regards its main assembly room, seating 1,500, by an indirect system providing soft and artistic illumination. Energy for the building's 2,500 lamps and 250 hp. in motors is supplied by the central-station company.

**Radio Service Between Chicago's High Schools.**—Chicago's twenty-two high schools are, according to the *Wireless Age*, to be equipped with radio-telephone and radio-telegraph instruments. This school system, the first of its kind, will be installed at a cost of about $50,000 and will make it possible to transact virtually all inter-high-school business by radio. Stations have already been established at two of the schools, the telephones having a day range of about 100 miles for the transmission of intelligible speech and the telegraph instruments a day range of approximately 200 miles.

**Metric System Gains Ground in the Orient.**—At a recent session of the French Academy of Science it was announced on the authority of the director of the Bureau of Weights and Measures of Tokyo that the Japanese Parliament had made the adoption of the metric system compulsory in Japan. The system was made legal in that country in 1893, but heretofore the native measurements and the English system have had equal rights with it. In China and in Siam laws paving the way toward the obligatory adoption of the metric system have been in effect since 1913 and 1912 respectively, and the preparatory period in the case of China will expire in 1923. Thus in a few years a large part of the Orient is likely to have officially adopted the method now finally indorsed by Japan.

**Improved Lighting for Kansas City's Streets.**—The lighting committee of the Chamber of Commerce of Kansas City, Mo., has made recommendations which have as their object making Kansas City the best-lighted city in the United States within two years. The plan advocated involves the discontinuance of all gas lamps on the city's streets and entering into a contract with the Kansas City Power & Light Company for the illumination of all streets, boulevards and viaducts, 600-cp. units to be used in the downtown districts and 400-cp. units in outlying sections. All-night lighting of every street is urged. The committee declares that "the gas lighting now so much in use in Kansas City is a disgrace to any community, and its apparent cheapness does not offer any excuse for its use." It is also asserted that "little or nothing is to be gained by the city owning its street-lighting system at this time."

**Electricity and Mushrooms.**—Electrical energy is now playing a part in the cultivation of mushrooms, according to the *Edison Monthly*, which quotes the manager of a mushroom plantation started in a former brewery in the Borough of the Bronx, New York City, as saying: "We are really experts in making weather which is best suited for mushroom growth. Sunshine, wind, rain, moisture, fog, heat, cold and even lightning are at our command and in our control. With the help of science we have been able to operate our mushroom plantation 365 days in the year, something never attempted before in this country." Although the mushroom farm was started in the brewery cellars, it now occupies also all the upper floors, and the possibility of growing mushrooms in such surroundings is said to be due entirely to an application of electricity, of which the method is for the present being kept a secret.

# Associations and Societies

**A complete Directory of Electrical Associations is printed in the first issue of each month.**

**A. I. E. E. Annual Meeting.**—The annual meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York City, on May 20. The result of the annual elections will be announced and the report of the board of directors presented.

**A. I. E. E. Section Meetings.**—Transmission at 220,000 volts will be discussed at a meeting of the San Francisco Section, A. I. E. E., on May 27, Prof. Harris J. Ryan giving the main paper. At a Baltimore Section meeting on May 20 J. T. Corrin of the Pittsburgh Transformer Company will discuss transformers. The Akron Section will meet on May 25.

**Electric Supply Jobbers' Association.**—M. H. Aylesworth, executive manager of the N. E. L. A.; W. L. Goodwin, assistant to the president of the Society for Electrical Development; Herman Plaut, sales manager of L. Plaut & Company, and other representatives of the electrical industry will address the meeting of the Electrical Supply Jobbers' Association to be held at Hot Springs, Va., on May 25-27.

**Engineers' Club of Philadelphia.**—On Tuesday, May 17, Axel Malm, president of the Federal Engineering Company, will speak at the club luncheon on "Business Methods of European Engineers Compared with Those of American Engineers." The annual meeting of the club will take place on the evening of the same day. Among affiliated society meetings next week are those of the American Welding Society on Monday and the Illuminating Engineering Society on Friday.

### Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Pittsburgh, May 14.

A. I. E. E. Section Meetings — Cleveland, May 17 (dinner); Baltimore, May 20; Akron, May 25; San Francisco, May 27.

American Washing Machine Manufacturers' Association—Chicago, May 18-19.

Southwestern Electrical and Gas Association—Galveston, Tex., May 18-21. (For program see issue of May 7, page 1066.)

National Electric Credit Association—Richmond, Va., May 19-20.

A. I. E. E. Annual Meeting—New York, May 20.

American Society of Mechanical Engineers—Chicago, May 23-26. (For program see issue of May 7, page 1069.)

Electrical Supply Jobbers' Association—Hot Springs, Va., May 25-27.

American Society of Safety Engineers—New York, May 27.

N. E. L. A. Annual Convention—Chicago, May 31-June 3. (For program see issue of May 7, page 1065.)

N. E. L. A., Pacific Coast Division—Del Monte, Cal., June 7-9. (For program see issue of Jan. 29, page 278.)

N. E. L. A., North Central Division—Duluth, Minn., June 14-16.

National Fire Protection Association—San Francisco, June 14-16.

Tri-State Water and Light Association—Asheville, N. C., June 15-16.

Canadian Electrical Association—Quebec, June 15-17.

California State Association of Electrical Contractors and Dealers—Santa Cruz, June 16-18.

A. I. E. E. Annual Convention—Salt Lake City, June 20-25. (For program see issue of April 30, page 1009.)

National District Heating Association—Cedar Point, Ohio, June 22-24. (For program see issue of May 7, page 1069.)

N. E. L. A., Iowa Section—Lake Okoboji, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ontario, June 23-25.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 27-30.

# Recent Court Decisions

**Findings of higher courts in legal cases involving electric light, power and other public utility companies**

**What Are Navigable Waters?**—The Supreme Court of North Dakota has held, in Roberts vs. Taylor, that in determining the status of an inland lake in that state the test of "navigability in fact" is not confined to a capacity for use in commerce of a pecuniary value, but may be extended to capacity for use for purposes of navigation for pleasure, public convenience and enjoyment, and that a lake used for boating and hunting is navigable and the title to its bed vests in the state. (181 N. W. 622.)*

**Employer Liable for Defective Insulation, Though Not in Control of Grounded Wire.**—Where a repairman working on an insulated platform was killed by an electric shock from a defectively insulated feed wire, the Supreme Court of Missouri has held (Sudmeyer vs. United Railways Company of St. Louis), the master's liability for the defective insulation is not defeated by the fact that the accident could not have occurred unless the man was in contact with a grounded wire, the master not being in control of such wire, since the defective insulation and the grounded wire were concurring causes. (228 S. W. 64.)

**Liability for Death from Wires Charged to Prevent Theft of Copper.**—In Evans vs. Oskaloosa Traction & Light Company the defendant appealed from a verdict holding it responsible for the death of a workman engaged in removing iron pipe from the mine of a coal company (intervener in the suit). It appeared that service to the mine had been discontinued, but that the electric company kept its 11,000-volt wires charged to prevent theft of the copper. These wires were strung on poles 22 ft. above the ground, but the upper end of a long pipe which the deceased was handling came into contact with them, causing his death. The Supreme Court of Iowa found that the plea that the electric company did not have notice that a person lawfully employed might come into contact with the wires could not absolve it, in the face of its knowledge that the mine was to be abandoned, that machinery had been removed therefrom, that the process of dismantling had started and that the electrical energy was no longer desired for the operation of machinery. Whether the electric company was negligent in turning on the current without notice to the coal company was for the jury to determine. (181 N. W. 782.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

**Illegal Commission Procedure Alleged in North Dakota.**—The North Dakota Board of Railroad Commissioners consists of three members, and the question has arisen (State of North Dakota vs. Union Light, Heat & Power Company) whether an order signed by two of the commissioners is valid, the third commissioner asserting that adequate opportunity had not been afforded him to participate in consideration of the case. The order, it is alleged, was never adopted by a majority of the board at any regular or special session, and the city of Fargo, whose interests were involved, did not have a hearing. Pending a final determination of this issue, the Supreme Court of North Dakota has permitted the Union company and the Red River Power Company, which is also concerned, to collect surcharges authorized by the disputed order, subject to refund in the event of its being ultimately declared invalid.

**Under Colorado Constitution Municipality Can Control Rates in Opposition to State Commission.**—The Supreme Court of Colorado has determined, in City of Fort Collins vs. Public Utilities Commission, that under the state constitution and the "home-rule amendment" a municipal corporation has power to assume the regulation of rates, because such a body may assume whatever power the Legislature may grant. The question, the court holds, is not whether the sovereign power is precluded from fixing rates, but whether when the people of the state by constitutional amendment have given such power the Legislature can take it away. The fact that the Fort Collins charter was adopted after the passage of the home-rule amendment was held not to affect the issue, the proposition that this amendment was intended to give authority to regulate rates to some cities and not to others being, in the language of the court, "almost incredible." (195 Pac. 1099.)

**Electrically as a Dangerous Element—When Appellate Court May Hold Damages Excessive.**—In affirming a verdict for damages because of the death of a lineman from electric shock (Nichols vs. Hines, Director General of Railroads) the Appellate Court of Indiana declared: "That electricity is a dangerous element is a fact so firmly established and well known that so to assume and state in an instruction where dangers arising from its use are involved is not error." Regarding a plea to reduce the amount of damages as excessive the court said: "In order to hold that the damages assessed are excessive it is not sufficient to say that in our opinion they are too high and that we would have given a less amount had the matter been submitted to us as an original question. In order to justify us in reversing the judgment on such ground the amount of damages assessed must appear to be so outrageous as to impress the court at first blush with its enormity." (130 N. E. 140.)

# Commission Rulings

**Important decisions of various state bodies involving or affecting electric light and power utilities**

**To Charge Town Containing Plant and Town Served by Transmission Alike Is Discriminatory.**—A rate for electric power service to a community served by means of transmission lines no greater than the rate at the town where the energy is generated is, the Missouri Public Service Commission has found, discriminatory, the burden upon the utility caused by the existence of the transmission lines being a proper factor in fixing rates.

**Customer Ownership of Meters Not Approved.**—A meter, in the view of the North Dakota Board of Railroad Commissioners, is as much a part of the property of the utility company as any other instrument of its plant or distribution system, and as such should be owned and maintained by it on the same basis as any other part of its capital equipment, ownership of meters by consumers offering a possibility for discrimination between the renter of meters and the owner thereof.

**Relation of Load Factors to Diversity of Use.**—This relationship was recently discussed in the following terms by the Public Utilities Commission of Utah, in connection with commercial rate making for the Utah Power & Light Company: "If a particular consumer among many operates above the ideal load factor, such consumer is not making use of his portion of peak capacity in relation to the total water he is using, because he is taking relatively less installed capacity than is the case at ideal load factor, and, if operating at less than the ideal load factor, such consumer is using relatively more than his portion of peak capacity in relation to the total water he is using. However, as an abstract proposition, very high load factors may or may not allow of diversity in a commercial sense. It depends upon the form of load curve and method of measurement and duration of peak. Again, at lower load factors, a corrective factor for diversity of use is allowed for the reason that consumers of these lower load factors do not, as a matter of fact, establish their maximum demands simultaneously. Hence the sum of all maximum demands established by different customers will be greater than the simultaneous demand that the utility must meet. The plant capacity may therefore be less than the sum of all individual maximum demands. The consumer should, therefore, benefit by a reduction from the fixed costs found applicable to system costs at low load factors."

# Men of the Industry

**Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry**

**William States Lee,** vice-president and chief engineer of the Southern Power Company, Charlotte, N. C., has been elected president of the Piedmont & Northern Railroad, succeeding the

W. S. LEE

late Z. V. Taylor. Under Mr. Lee's direction as vice-president, the Piedmont & Northern Railroad has been built up since 1911 to a system that operates 130 miles of high-speed electric railway at 1,500 volts direct current, for general freight and passenger traffic, taking power from the Southern Power Company's system. Mr. Lee has been associated with engineering construction in the South for nearly twenty-seven years and has been responsible for the engineering work of the Southern Power Company since its organization in 1905. During this time he has designed and constructed eight hydro-electric plants and four steam stations, with an aggregate rating of 280,000 kva., in connection with which 201 outdoor substations and more than 2,000 miles of high-tension transmission lines are operated. The standards he has devised through experience in pioneer design and installation of power transmission equipment have been largely reflected in the practices of other large companies. He is also widely recognized as a pioneer and leader in the electrification of Southern industries. About a year ago Mr. Lee established a consulting engineering office in New York City which works in conjunction with the large engineering staff he maintains in Charlotte. Mr. Lee was born in Lancaster, S. C., on Jan. 28, 1872, and was graduated from the South Carolina Military Academy in 1894. His early experience was with the Anderson Water, Light & Power Company, Anderson, S. C., where he was engineer in charge of the construction of the Portman Shoals hydro-electric plant. There he placed in service in 1898 the first 11,000-volt generator to be installed in America. His work ever since has been characterized by initiative and originality. Other details of Mr. Lee's engineering career were given in the ELECTRICAL WORLD for March 20, 1920, page 699.

**John P. Mallet** has recently become affiliated with the Connecticut Dynamo & Motor Company, Irvington, N. J. For six years Mr. Mallett was designing engineer for the Westinghouse Electric & Manufacturing Company and for eight years chief engineer of the Northern Electrical Manufacturing Company. During the last few years he has been engaged in consulting engineering work, devoting most of his time to the designing of special electrical apparatus.

**Earl E. Whitehorne,** who has been confined to his home for several months owing to illness, is rapidly recovering his former strength and vigor. The next few months he plans to spend in recuperation in the mountains of Virginia. During this period he will devote some time, however, to special editorial work for the ELECTRICAL WORLD and *Electrical Merchandising* as contributing editor.

E. E. WHITEHORNE

Mr. Whitehorne's work as an editor for thirteen years, and more recently as an editorial writer and as a business counselor to electrical manufacturers, electrical jobbers and central-station companies on sales promotion programs, is well known to the electrical industry, and his many friends will be glad to learn that he is now sufficiently strong to devote some time to active duties again.

**P. M. Hatch** has recently been appointed superintendent of light and power of the El Paso (Tex.) Electric Company, where he has supervision of the commercial department, the electrical engineering for the company and the operation and maintenance of the generating stations, substations and lines. Mr. Hatch has had a broad experience in engineering, operation and management of various properties of Stone & Webster, the general managers

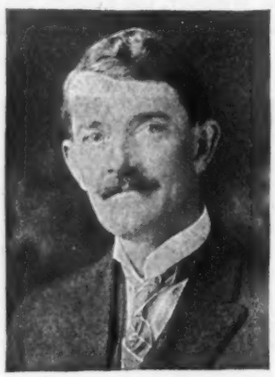
P. M. HATCH

of the El Paso company. He was born in Boston in 1888 and was graduated from Tufts College in 1910. Immediately he went to Port of Spain, Trinidad, British West Indies, where he worked for the Trinidad Electric Company, Ltd., first as apprentice and later as chief engineer of the generating station. In addition he looked after maintenance of the street cars. In 1912 he became associated with Stone & Webster in their Savannah (Ga.) office, where he did considerable engineering work. In December, 1914, he was sent to Ponce, Porto Rico, as general superintendent of the Ponce Railway & Light Company. In February, 1916, he was made manager of the company, remaining until he entered the army as first lieutenant in the Ordnance Department. Upon his discharge in March, 1919, he was for a short time placed on statistical work in New York, but was soon transferred to the office of the manager of the Southwestern district of Stone & Webster at Savannah, Ga. In January, 1921, he was transferred to his present position.

**R. S. Daniels,** electrical engineer with the Washington Water Power Company for fifteen years, has left for Berkeley, Cal., to take a position as assistant to the chief engineer of the California-Oregon Power Company of San Francisco. The company operates a number of plants in southern Oregon and northern California. Prior to his departure

a dinner was tendered to Mr. Daniels by the Spokane Section of the American Institute of Electrical Engineers, of which section he has been chairman during the last year.

**H. R. Noack** has been elected vice-president of the Pacific States Electric Company, well-known jobber on the Pacific Coast, in recognition of the constructive work he has done in the promotion of high-tension transmission construction. Mr. Noack was graduated



H. R. NOACK

from the University of California with the class of 1898 and became associated with John Martin in the selling of electrical apparatus. When this firm was succeeded by Pierce, Roeding & Company he had charge of the sales of transmission and railway equipment. Later, when that firm sold out to the Aluminum Company in 1916, he became connected with the Pacific States Electric Company in charge of the high-tension transmission department. Mr. Noack recently closed with the Anaconda Copper Company an order for 10,000,000 lb. of copper wire for the Pacific Gas & Electric Company. This is said to be the largest single order for copper wire ever placed in this country.

**E. C. Marshall**, formerly treasurer of the Southern Public Utilities Company, has been elected president of that company to succeed the late Z. V. Taylor. Mr. Marshall has been treasurer of the company since its organization in 1913 and has been closely associated with Mr. Taylor in the direction and development of its properties. He first became associated with the Southern Power Company in the capacity of auditor in its early days. In 1910, when the Southern Power Company began to acquire the utilities at Charlotte, Winston-Salem, Greenville, Anderson and surrounding sections, Mr. Marshall was associated with the management of these properties, and in 1913, when the merger of the utilities serving these towns resulted in the organization of the Southern Public Utilities Company, Mr. Marshall continued as treasurer and was closely associated with Mr. Taylor in their management. The election of Mr. Marshall as president is in line with the policy of the company consistently followed by Mr. Taylor to seek within its own organization men to fill higher positions.

**Walter C. Strunk** has tendered his resignation in the mechanical research and construction division of the motive-power department of the Interborough Rapid Transit Company, New York City, to accept a position in the stoker division of the Westinghouse Electric & Manufacturing Company, Lester, Pa. Mr. Strunk was born in Reading, Pa., in 1885 and was graduated from Swarthmore College in 1909. In the same year he started work with the Metropolitan Street Railway Company, New York City, in the training school for college men. After spending two years in the school he entered the electrical department. In 1912, when the New York Railways Company was reorganized, he was made an assistant engineer in the motive-power department of the Interborough Rapid Transit Company and New York Railways Company. His work up to 1917 was in the economics division. Since that time he has been in charge of all tests and research work in connection with mechanical power station equipment.

**C. W. Whiting** has been appointed manager of the municipal lighting system at Wakefield, Mass.

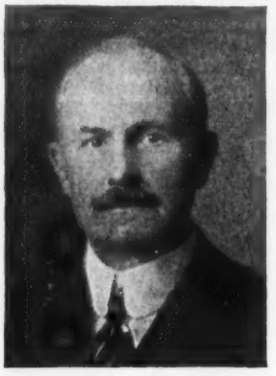
**H. J. Moulton**, whose appointment as district manager of the Southern California Edison Company at Redlands, Cal., was recently announced in the ELECTRICAL WORLD, was born in Seymour, Ind., in 1879 and spent his early life in Massachusetts. He came to California in 1903 and was employed by the American Bell Telephone Company until 1907, when he entered the commercial department of the Southern California Edison Company as

H. J. MOULTON

power salesman. Mr. Moulton was appointed assistant district manager of the Redondo district in July, 1920, and promoted to be district manager at Redlands on Jan. 1, 1921, succeeding P. S. Miner.

**Oscar H. Perkins**, sales manager of the Stuart-Howland Company, Boston, has been elected president of the Municipal Electric Light Association of Massachusetts.

**J. J. Ashworth**, who was appointed general manager of the Canadian General Electric Company, following the resignation of Senator Frederic Nicholls as president and general manager to become chairman of the board of directors, has been associated with this or-



J. J. ASHWORTH

ganization for the past thirty-three years. In 1888 he joined the Edison General Electric Company, Toronto, as engineer, and when that company was absorbed by the Canadian General Electric Company, Ltd., he joined the engineering staff of the latter company. In 1895 he became associated with the contracting department and in 1903 was made sales manager. In 1908 he was appointed assistant to the general manager, and he has since worked closely in association with Senator Nicholls. Mr. Ashworth rendered valuable service in organizing war production, and in 1919 he was elected a director of the company.

**R. P. Payne** has been appointed head of the household appliance department of the Northwestern Electric Equipment Company, St. Paul, Minn., to succeed B. C. Holst, who has become associated with W. N. Matthew & Brother, Inc., St. Louis.

**Frank H. Freeman** of the Anaconda Copper Mining Company has recently been appointed general sales manager of the Illinois Wire & Cable Company, weatherproof-wire manufacturer of Sycamore, Ill. Mr. Freeman assumed his new duties on the first of April.

**Randolph E. Tyler**, for fourteen years district representative of the Shelby division of the National Lamp Works, has been placed in charge of the lighting department of the Schimmel Electric Supply Company. This is part of the plan for expansion recently announced in connection with removal of this firm to its new and enlarged quarters at 526 Arch Street, Philadelphia.

# Trade and Market Conditions

**Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies**

## Some General Conditions that Indicate an Upward Turn

IT SEEMS apparent that a turn for the better and a change in business sentiment are indicated in some items of general business news. In April the failures showed a falling off for the first time in a great many months. Dun's, Bradstreet's and all of the large banks are now seeing hopeful signs in current business conditions. Federal Reserve Bank discounts are being lowered. This is occasioned by easier money and in turn has the effect of making money still easier, following which building prospects become brighter.

The number of idle freight cars is decreasing; although the decreased number is made up entirely of freight cars, nevertheless, if more coal was being moved, is it not indicative of a belief on the part of industry that greater production is soon due? This is not the time ordinarily for an increased shipment of coal, and coal is not ordinarily stored for more than thirty to sixty days.

Almost all business commodities are now down to a level which, while not in all cases equal to the pre-war level, still is of sufficient lowness to warrant resumption of activities on a fair scale. Steel is down and steel wages with it. The only item that is seen to be up is the item of freight, and pressure is now being brought to bear on that. It would not be unreasonable to expect lower freight rates within the next sixty days.

Non-employment in April was about the same as in March. Some industries show great lack of employment, but many industries show that non-employment is lessening. The indications are that from now on the numbers of unemployed can be expected to decrease.

There seems to be one answer—that business is now on the beginning of the floodtide. He who waits until the tide is full to cultivate this business will probably find that he has lost the momentum of being carried along on the wave. As a matter of fact, if he waits he may find that he will merely be left high and dry.

## Code Wire Sales Higher than Mill Orders Suggest

IN CONSIDERING the present volume of business in the rubber-covered-wire market and the volume consumed this year to date, figures show that during the month of April about 27 per cent more code wire was used than was used in March. An estimate of the amount of code wire that will have been consumed over the first five months of this year places it at about 67 per cent of that consumed over the same time in the last five years, excluding the extraordinary early business of 1920. These figures are interesting in view of the present wire market, which is generally characterized as quiet.

From the wire manufacturer's standpoint the amount of orders on his mills does not check up with these figures, probably by 50 per cent. This is because the trade has absorbed much more code wire than the distributers and jobbers have recorded from the mills. The jobbers have reduced stocks to what they consider a low level, but have not replenished.

The call for large-size solid and for circular-mil sizes has been relatively light compared with that for Nos. 8 to 14, but in the industrial sections of the Middle West the larger sizes are becoming more active. New England industries too are awakening. This is the time of year when wire consumption can be expected to show improvement. Building activity, residential, commercial and municipal, has shown a marked increase during April and was even noticeable during March. From the plans on foot at the present time it bids fair to bring more business to the wire market as the summer progresses. Labor difficulties, it is true, are holding up construction in several centers, but progress as a whole is upward.

In checking up the estimate shown in the ELECTRICAL WORLD of Jan. 1, 1921, of 1,700,000,000 ft. of code wire produced in the United States during 1920, the recent figures of the Underwriters' Laboratories, Inc., give a consumption of total code wire in the States during 1920 of 1,694,935,390 ft.

## New England Business Showing Hopeful Signs

ADMITTING the opportunity for great improvement in the New England business and manufacturing field, there are not lacking evidences of increasing demand for electrical and other products which bear out the opinion that trade is on the mend. Recessions take place, it is true, but an acute observer of conditions in the industry pointed out to a representative of the ELECTRICAL WORLD on Monday that each setback is less extensive than formerly. In many lines business is spotty, but none the less the buying public is a substantial purchaser of electrical service, domestic labor-saving conveniences and personal necessities of higher grade.

The liquidation of labor is proceeding slowly but surely, and there is no question that retail trade is responding to price movements downward. The textile industries exhibit improvement in woolen manufactures and in some cotton lines, where overtime is found necessary. Rubber-tire production is busier, two of the larger concerns now operating on three eight-hour shifts. Unsettled conditions appear in the leather field, and the metal industries are running on part time in the main. Twenty-four representative department stores reported to the Federal Reserve Bank 40 per cent more business in March than in February of this year. It appears that less credit is now required to finance the same volume of trade as compared with a year ago. Building operations are increasing, on the whole, and the declaration of the open shop by Boston builders after months of fruitless negotiating has been followed by a partial resumption of work on suspended jobs and in some cases by an excess of applications for work above the places open. Railroad traffic is light, and the financing of transportation needs, as elsewhere, is a difficult problem.

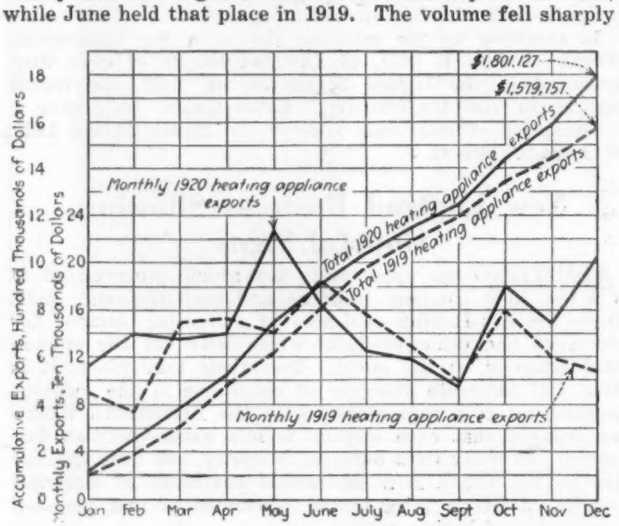
In the electrical field the central-station industry is doing a substantial business, some companies reporting marked increases in periodical outputs of energy sold compared with a year ago. Domestic appliance sales have been active, and vigorous merchandising is yielding good fruit. Electrical machinery makers are running considerably below capacity, but some good orders are reported and one electric pleasure-car concern is booked to capacity until fall. Contractor-dealers and jobbers are widely reporting a better feeling in trade. Schedule material factories are running on about half time. A fair trade is being handled in street-lighting equipment and in mercantile and domestic fixtures. Motor business is off at present, but electric accessories for automobiles are in good demand. Earnings of hydro-electric companies have held up remarkably well. Two large new central stations are

under construction in New England, and reductions in the cost of wire have had some effect in stimulating distribution system construction. Few failures have occurred in the electrical field, and the outlook is better now than for many months.

## Exports of Heating and Cooking Apparatus Grow in 1920

DURING the twelve months of 1920 the United States exported $1,801,127 worth of electrical cooking and heating apparatus. This shows an increase of 14 per cent in value over the exports of 1919, 162 per cent over those for 1918 and 43 per cent over 1917. In 1920 heating and cooking apparatus accounted for 1.75 per cent of total electrical exports, in 1919 the percentage was 1.75, in 1918 it was 1.14, and in 1917 it was 2.26 per cent of the total.

May was the highest month for these exports in 1920, while June held that place in 1919. The volume fell sharply


$1,801,127
$1,579,757
Monthly 1920 heating appliance exports
Total 1920 heating appliance exports
Total 1919 heating appliance exports
Monthly 1919 heating appliance exports
Accumulative Exports, Hundred Thousands of Dollars
Monthly Exports, Ten Thousands of Dollars
0 2 4 6 8 10 12 14 16 18
0 4 8 12 16 20 24
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

INCREASE OF 14 PER CENT IN 1920 OVER 1919 EXPORTS

in each of those two years until September, which showed a substantial recovery.

As showing the disposition of the market, Canada took the greatest amount, with $346,409 worth. This was well ahead of Norway, but Norway dropped considerably below her receipts of the year previous. Australia, England, Argentina and Brazil were all close together, but in 1919 Japan came in in third place. The first eight countries in 1920 were the highest eight in 1919 also but did not hold the same relative rank.

British South Africa and Peru followed Uruguay in 1920

1920 AND 1919 HEATING AND COOKING APPARATUS EXPORTS

| Country | Value of 1920 Exports | Value of 1919 Exports |
|---|---|---|
| Canada | $346,409 | $313,632 |
| Norway | 197,980 | 274,438 |
| Australia | 138,516 | 78,565 |
| England | 133,990 | 95,174 |
| Argentina | 132,847 | 94,655 |
| Brazil | 132,334 | 64,790 |
| Mexico | 112,451 | 64,776 |
| Japan | 78,942 | 115,108 |
| New Zealand | 62,715 | 55,305 |
| Cuba | 52,771 | 56,901 |
| Spain | 44,500 | 26,534 |
| British India | 32,934 | 11,656 |
| China | 30,610 | 22,266 |
| Netherlands | 30,496 | 13,378 |
| Uruguay | 29,614 | 50,424 |
| 74 Countries importing under $25,000 each | 243,988 | 242,195 |
| Total exports of heating and cooking apparatus | $1,801,127 | $1,579,797 |

and were also in the ranking in the previous year, but in 1920 they were below the $25,000 mark, which was used as a base both years. British India, China and the Netherlands came into this class in 1920. These fifteen countries above $25,000 received a total of $1,557,139 in heating goods in 1920, while in 1919 they took $1,337,602. The seventy-four countries receiving less than $25,000 in 1920 took in $243,988 worth, while in 1919 they took $242,195. It is interesting to note that the fifteen leading countries increased their purchases 16.4 per cent in 1920 over 1919, while the countries using the rest of the exports increased less than 1 per cent.

It is noticeable that many of the foreign countries have heating and cooking rates which permit of the use of their hydro-electric energy in this way over long periods of time and at a very low cost.

These figures were compiled by the ELECTRICAL WORLD from data gathered by the Bureau of Foreign and Domestic Commerce.

## Loom Prices Steady, Though Demand Is Light

ALTHOUGH demand for non-metallic flexible conduit is reported as being very light throughout the country, manufacturers' prices have held steady for several months. The last reduction that occurred was one increasing the discount allowed jobbers by fifteen points, a cut of 30 per cent, made the first of the year. Buying has remained at a low point, with both jobbers and manufacturers for the most part carrying sizable stocks and endeavoring to reduce inventories.

Producers have been cutting down their inventories on loom by decreasing production. One of the largest manufacturers has not operated this department since the first of the year and still has a considerable quantity of material on hand. Other manufacturers have curtailed operation in somewhat like proportion.

The general view expressed as to the outlook for business in this line is that conditions will remain considerably below normal for some months to come. The present price of loom is considered to be on a firm basis with cotton about as low as it can well go, but the reaction of the building construction industry thus far has been disappointing.

## The Metal Market Situation

THE copper market has developed a stronger, more confident tone recently with a corresponding slight firming of prices. This is largely a result of the improved statistical position of the market. It is reported that wire drawers have displayed more interest than has heretofore been the case, but the total demand for copper is still small. Prompt, May and June deliveries are held at 12.75 cents per pound in some quarters, but other producers hold June at 13 cents. July is held at 13 to 13¼ cents. In the outside market prices are fully as high if not more so.

The lead market has developed a strong situation due to advances abroad that bring the cost of importation over 5 cents per pound. The "official" New York price has again jumped and is now 5 cents. There is very little buying of zinc, but there is also so little selling pressure that the tone of the market is steady.

Among the scrap metals the demand is quiet but nevertheless developing a little. Scrap lead continues to advance in line with the parent metal.

NEW YORK METAL MARKET PRICE

| | May 3, 1921 | May 10, 1921 |
|---|---|---|
| Copper | £ s d | £ s d |
| London, standard spot | 71 5 0 | 72 0 0 |
| | Cents per Pound | Cents per Pound |
| Prime Lake | 12.75—13.00 | 13.00—13.25 |
| Electrolytic | 12.75 | 12.75 |
| Casting | 11.75 | 12.12½ |
| Wire base | 14.50—15.00 | 14.50—15.00 |
| Lead, trust price | 4.50 | 5.00 |
| Antimony | 5.25 | 5.25 |
| Nickel, Ingot | 41.00 | 41.00 |
| Sheet zinc, f.o.b. smelter | 11.00 | 11.00 |
| Zinc, spot | 5.45 | 5.40 |
| Tin | 31.62½ | 31.87½ |
| Aluminum, 98 to 99 per cent | 28.00 | 28.00 |

OLD METALS

| | Cents per Pound | Cents per Pound |
|---|---|---|
| Heavy copper and wire | 10.00—10.50 | 10.00—10.50 |
| Brass, heavy | 5.50— 5.75 | 5.50— 5.75 |
| Brass, light | 3.75— 4.00 | 3.75— 4.00 |
| Lead, heavy | 3.75— 3.90 | 4.10— 4.37½ |
| Zinc, old scrap | 2.87½- 3.00 | 2.87½- 3.00 |

# THE WEEK
## IN TRADE

**Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points**

ALTHOUGH the general feeling in industry is slowly but steadily getting better and general economic conditions are pointing upward, better buying has not yet been felt in the electrical industry in all sections of the country. Improvement is shown in the Northwest, Southwest, Intermountain and New England States, particularly in building construction; but in the Middle Atlantic States, in the Chicago territory and to some extent in the South the buying shows little improvement. In the South, however, better ordering is reported by jobbers of material for use in July and August. Farm-plant sales and refrigeration equipment are good there.

Most buying, though, is to replenish already low stocks, and shipments are favorable for this. Wire and armored conductor prices are softer in New York, and some makers of flatirons have just lowered their lists. Collections continue slow.

### NEW YORK

Jobbers have apparently made up their minds that business will continue slow throughout the summer and are acting accordingly. Little or nothing is being bought, except what is needed to replace stock, and attention is being devoted to cleaning out the slow-moving items. Except for stocks of wire, inventories are generally in pretty good shape.

The first break in the direction of another general cut on heating devices has been made, one manufacturer announcing a 15 per cent reduction. There is little likelihood that price cutting will stimulate business, however. Rubber-covered wire is quoted down to new low levels in this territory, as is also armored cable, but demand is no better. Spring buying of household appliances such as vacuum cleaners and washing machines has been disappointing, and fans have not started to move. A number of houses, however, despite the quiet market, report a slight improvement in the general situation.

**Conduit.**—Some stocks are small, others are good, but demand continues only fair. Current prices quoted in lots of 2,500 ft. are as follows: ½-in. black, $60 to $67; ½-in. galvanized, $67 to $72.60; 1-in. black, $116 to $131.60; 1-in. galvanized, $125 to $141.80 per 1,000 ft.

**Flexible Armored Conductor.**—Demand is very small and stocks are down pretty well too. From $60 to $62.50 per 1,000 ft. is quoted this week on No. 14, two-wire, double-strip, in lots of 1,000 ft.

**Fans.**—Large supplies are held by jobbers, and these have hardly started to move at all as yet.

**Wall Cabinet Boxes.**—Jobbers' stocks are small, but one-day shipments can be obtained. Manufacturers report that demand is light. Prices have remained steady the past month, the recent drop in steel prices having been anticipated by decreases of 45 to 50 per cent thus far from the peak price.

**Lamp Cord.**—This market shows absolutely no activity, while stocks are spotty. In 1,000-ft. lots No. 18 cotton, twisted, sells for $13.75 to $18.50, and parallel from $16 to $19.75.

**Rubber-Covered Wire.**—Prices are tending lower, with a large house this week selling No. 14 single-braid in 10,000-ft. lots at $6.75 per 1,000 ft. and others ranging up to $7.70. Demand remains light and stocks are good.

**Fuses.**—Good supplies are held of all types, but sales are quiet. In standard packages, non-renewable, N. E. C., 30-amp. fuses sell for about 9 cents each.

**Washing Machines.**—Prices are steady, though very few are being sold and the number carried in stock is kept down.

**Vacuum Cleaners.**—Demand is not very active this spring, though some sales are being made. There is a prejudice against ordering in very large quantities apparently. Prices are steady.

**Heating Devices.**—Certain manufacturers have changed their list prices on flatirons so that they now vary from $7.75 to $8.50. These include Hot Point, Westinghouse and American Beauty. In the latter case the reduction amounts to 15 per cent.

### CHICAGO

Although dullness in the market is wholly unrelieved, many factors are developing which point to an early change. An important ruling by the Federal Reserve Bank in the Seventh District effects a reduction of 1 per cent in the discount rates, 6½ per cent now being the charge on commercial and industrial paper and trade acceptances.

As has been the case for some weeks, prices have but small effect on volume of business just now. The unsettlement in the building trades persists, and all large work is thereby suspended. The commission investigating conditions in the construction industry is still at work, and naturally but few projects are showing any progress until these matters are adjusted. General industrial conditions continue to improve in that the stockyards and printers' strikes have been terminated and forces in all manufacturing plants are being very gradually augmented.

Collections remain very slow, as the retailer is not only making few sales but is being compelled to grant extensions on time payments. Conversation with several large installment furniture stores develops the fact that their collections have been gradually improving since a low point established in the first week in April.

**Bare Copper Wire.**—Although the market on bar copper is off a fraction, the quotation on wire remains unchanged. In quantities of 1,000 lb., No. 8 is quoted at 16 cents per pound. This price is subject to shading on large lots. Business in bare wire has been good in comparison with trade in other commodities, but this week it is again quiet.

**Insulated Copper Wire.**—A drop of ½ cent per pound has been noted in the past ten days, base on triple-braid weatherproof now being 17½ cents. This makes No. 6 wire 18½ cents per pound. Even at this low figure few sales are being made. No. 14 rubber-covered is variously quoted at $7.50 to $7.75 per 1,000 ft. in 5,000-ft. lots.

**Conduit.**—The tie-up in building has put a decided damper on trade in conduit, demand being at a minimum and price changes apparently unable to stimulate the call. In 5,000-lb. lots ½-in. black is quoted at $62 per 1,000 ft. In larger lots prices are subject to negotiation.

**Flexible Armored Conductor.**—Demand remains at a low ebb, this commodity also being affected by building conditions. Prices remain unchanged, the two-wire, No. 14, being priced $62 per 1,000 ft. in 5,000-ft. lots.

**Poles.**—New prices on Western poles have induced many inquiries, although but few large transactions are reported.

**Line Hardware.**—Inquiries are becoming quite numerous, and with the advent of excellent weather some orders are being reported.

**Heating Appliances.**—Dealers report that with the slight improvement which has been noted in the employment situation there is a little increase in retail demand. The feeling still holds on the part of the public that prices are too high, and this feeling is shared to a certain extent by the dealers themselves. Flatirons and toasters continue to be the best sellers in the line.

**Washing Machines.**—Intensive selling efforts continue to bring proportionate results. A very large percentage of sales are of the higher-priced machines, on deferred payments, probably because these high-priced machines are better advertised and more consistently pushed by retailers.

## BOSTON

A persistently better feeling is evident in trade, although as yet increases in the volume of business are irregular. Stocks have been further reduced in many lines, but deliveries are in general excellent for the demand existing. Prices have not moved much in the past week, barring unsteadiness in wire and flexible armored conductor. Building contracts fell off considerably compared with the previous week, but a decided improvement can be seen in actual construction under way, notably in Boston and around Hartford. Collections remain slow, but are holding their own from week to week at present. New factory construction is announced for Winthrop, Me., in replacing structures recently destroyed by fire.

**Wire.**—Weakness in prices is the feature of a moderate demand. Rubber-covered No. 14 was selling at Boston Monday at $7 per 1,000 ft. in 5,000-ft. lots to $8.25 for smaller quantities. Weatherproof base was 16 cents, with a quiet market and good stocks.

**Flexible Armored Conductor.**—Unsteady prices exist, running from $65 per 1,000 ft. in 5,000-ft. lots downward to $60 or lower on a pinch in larger quantities, in order to move accumulated stocks.

**Dry Cells.**—Small-quantity prices in a leading make are announced to be $1.35 higher per 100 than formerly. The No. 6 cell brings $44.35 per 100 in lots of 12 to 50, and in lots of 50 to 125, $40.35 per 100. A fair trade is being handled, with renewals active.

**Lamps.**—Business is lower in volume than a year ago, but distributers find a good staple demand existent. Stocks in all types and sizes are good. Sign lamps are moving more actively, relatively, than most other types.

**Metal Molding.**—Several good orders were handled last week in this material. It is plentiful in supply and prices are firm.

**Motors.**—Few motors are moving in the market compared with normal business.

**Porcelain Insulating Material.**—Demand is easy, with prompt deliveries for offered business. "Nail-It" knobs sell for $27 per 1,000 in barrel lots and 3-in. tubes for $9.50. High-tension line insulators are not as easy to obtain as low-tension fittings.

**Schedule Material.**—Some jobbers are prepared to buy substantially if price concessions come, it is said on good authority. At present only moderate sales are being handled and representative factories are running on about half time.

**Lamp Cord.**—Easy conditions prevail as to deliveries, with quiet demand and a typical price of $18 per 1,000 ft. in 1,000-ft. lots, No. 18 cotton-covered.

**Rigid Conduit.**—Moderate quantities are being required for sub-normal building construction work. Stocks are satisfactory on the whole, and prices reflect recent downward tendencies in the steel industry. For 5,000 lb. or less 1-in. black pipe sells at $131.20 in Boston.

## ATLANTA

The announcement of the Sixth Federal Reserve District that the discount rate would be reduced has been received as a hopeful sign by all lines of business, and the general conclusion is that this reduction will serve to stimulate business throughout this district.

There is a well-defined opinion among the electrical jobbing trade that conditions will have approached quite normal by July or August, and the more progressive firms are laying out schedules anticipating this condition. This has taken the form of orders for material that they feel will be first to move and in which they have allowed stocks to become depleted for several months past. The spell of unseasonable weather that has been prevalent in this section for the past ten days has served to check the seasonable demand for electrical specialties and has materially interfered with agricultural activities.

**Farm-Lighting Outfits.**—The taking over by state and counties of small schools has caused considerable activity in this line, it apparently being the intention of the school authorities to consider seriously the installation of moderate-size farm generating outfits, especially in the larger rural schoolhouses. Sales and inquiries are reported as quite good, while stocks are at present ample; though shipments are slow. A price reduction of 10 per cent was announced recently.

**Industrial Motors.**—Small ice plants and the installation of an unusual number of refrigerating plants are moving a fair volume of the moderate-size apparatus. Inquiries are coming in from the industrial plants, but as yet few orders have materialized. Stocks are in good condition and shipments excellent.

**Meters.**—These continue dull, the only movement of note being in the 5-amp. and 10-amp. sizes, except in the case of the large central-station companies. Stocks are reported ample, with shipments satisfactory.

**Oil-Engine Generating Sets.**—The issuance of bonds by several of the smaller municipalities is stimulating sales and inquiries in this line, especially in Florida and sections of southern Alabama, the interest being centered over a range in size of from 25 kw. to 200 kw.

**Rigid Conduit.**—Another small drop in market quotation is reported, averaging 5 per cent. Only a fair volume of sales is reported. Jobbers are placing respectably sized orders for stocks in anticipation of renewed life in the near future.

**Poles.**—It is reported that producers have been forced to accumulate heavy stocks at point of shipment, owing to the failure of the trade to make purchases in anticipated volume. Purchases are confined to immediate requirements only, central-station companies avoiding the accumulation of more than current supplies.

**Wire.**—A further slight reduction in this line is to be noted this week, weatherproof now being on a 16½-cent base and rubber-covered on a 16-cent basis. The volume of orders is small, sales of Nos. 6, 8 and 10 weatherproof and 14 rubber-covered being in the majority.

## ST. LOUIS

Business unquestionably is improving for retailer, jobber and manufacturer in every industry. This is the general report. With some it is normal, with others still quite slow, but every one reports substantial improvement in April over the average since the first of the year. This is particularly true with the electrical jobbers. The increase in their case cannot be especially attributed to any one line of goods carried, as a gradual and healthy improvement in demand is found in almost every item. Former overstocks now are about in line.

Some improvement in construction is noted, but a vast amount is being withheld until building costs shall be lower. It is considered improbable that much reduction in labor will be obtained until the latter part of this year or the first of next year. A number of the building trades have been successful in securing contracts with the employers for another year without the expected 20 per cent reduction, and it seems to be the tendency among the contractors to waive the reduction in order to get what business there is available. Apparently to justify prices for materials, the St. Louis Material Dealers' Association has asked the Attorney-General to make an investigation of its activities. Kansas City is reported to have a building boom, but this is principally for residences, and the general attitude of business is to wait for lower costs.

New power business is at a low ebb, but a healthy number of inquiries are reported. Kilowatt-hour sales in St. Louis continue to show larger monthly totals than for the same months last year by more than 5 per cent.

**Meters.**—One jobber reports a good business throughout the Southwest due to expansion on the part of central stations. Prices are firm and stocks are in healthy condition.

**Poles and Cross-Arms.**—Continued improvement in demand is reported, which is due principally to transmission extensions by the utilities. Moreover, a good volume of in-

quiries is being acted upon, and the indications are for a good business all summer.

**Wire.**—No. 14 rubber-covered shows increased sales, but the other sizes are lagging. Almost all quotations for all kinds and sizes of copper wire are on a 16-cent base. Special cases will be found where lower quotations are made to reduce a heavy stock in some particular kind.

**Knobs and Tubes.**—The prices are reported to be steadier now, as some of the large stocks held locally have been considerably reduced. Demand is still low. The price of "Nail-it" knobs ranges from $24 to $28 per 1,000 and 2½-in. tubes from $8 to $8.75 per 1,000.

**Dry Cells.**—Good sales and healthy stocks are reported. In barrel lots the regular cell is selling at 38 cents, but there is reported on the market a cell priced at 28 cents.

**Fans.**—Retailers report that the "advance guard" is in the market for fans. Jobbers advise that retailers are buying but not heavily, as they are waiting to see what weather the month of June brings forth. Local stocks are low, but the jobbers are buying conservatively.

**Washing Machines.** — Retailers and jobbers report increased sales of washing machines.

**Motors.**—Local jobbers report large stocks and slow movement. The demand from the industrials is expected to be improved by fall. At present a tremendous overstock of fractional-horsepower motors is reported.

**Flatirons.**—While retailers report fairly good sales, they are apparently buying conservatively in the expectancy of a reduction in the wholesale price, which is the same as it was a year ago. Reductions in retail prices have had a tendency to promote consumer purchasing.

## SAN FRANCISCO

The labor situation occupies the center of the stage. In the first place the seamen's strike has tied up coast and oceangoing traffic. There has been some violence, and all signs point to a bitter strike unless a nation-wide decision restores the situation. In the second place, the building trades unions, having refused to accept a wage reduction of 7½ per cent, advised by a board of arbitration, a general walkout has been ordered. In San Francisco all large buildings under construction are reported to be tied up, and although the electrical crafts are not directly affected, within the next week they will be automatically out of employment. Stock conservation is being vigorously practiced by the local jobbers, fast-moving stocks being ordered in smaller amounts and slow-moving items being followed in the way of special sales effort and substitution where possible.

Within the past month excursions have been made to the Pacific Gas & Electric and to Great Western Power projects at Lake Spaulding and Lake Caribou respectively to explain better to bankers, representative public men and members of the electrical fraternity the magnitude of the schemes and their importance in the general prosperity of the state.

**Rubber-Covered Wire.**—Prices are still tipping, No. 14 single-braid solid being offered to dealers in 5,000-ft. quantities at prices ranging from $7.20 to $7.75 per 1,000 ft. f.o.b. Coast cities. Local stocks are very good. April was a better month than March, although both run considerably less than the corresponding months of last year.

**Sewing Machines.**—This is the season of greatest drive on sewing machines, and an increased movement of stocks is reported. Electrical dealers themselves are still to be "sold" on sewing-machine merchandising, for their sales do not approach the proportionate sales on washers and vacuum cleaners. The larger buyers seem to be holding off in expectation of price decreases.

**Heating Material.** — Prices of heating material have dropped, with virtually all the manufacturers participating in the general decrease. Hot Point irons, No. 6, are listed at $8, subject to previous quantity discount; Westinghouse at $7.75; Western Electric, No. 6½, also at $7.75, while the American Beauty, No. 6½, now lists at $8.50. These new prices will undoubtedly stimulate buying.

## SEATTLE—PORTLAND

Both jobbers and dealers in Seattle, with very few exceptions, report that sales for the first week in May show no change over any one week during April. The predicted increase in sales volumes for spring months has not materialized and from present indications will not do so. The contributing factors for this condition are mainly nonemployment, wage slashing, reduction in working forces in industrial and business institutions and the lack of building of real consequence. However, this last factor is showing improvement, especially during the past two weeks, in Seattle, where contracts for structures totaling considerably over $2,000,000 have been awarded. These contracts call for a high school, two apartment houses, a department store and two theaters. Residence construction is keeping up well, and this condition is expected to continue throughout the summer and fall. Tacoma reports state that during the month of April more permits for residences were taken out than in any single month for ten years. Unquestionably in the Puget Sound districts the real-estate market is improving, the most encouraging sign being in the number of transfers of down-town properties which are to be used by purchasers for locations for expanding business.

Electrical jobbers in the Portland field state that business is showing an increase and that while this is not great it indicates a trend in the proper direction.

In Portland contracting in small work continues fairly active, but larger contracts are scarce. Fixture business, owing to the increasing amount of residence construction, is showing satisfactory increases. Retail stores in Portland report everything very quiet, with a continued downward tendency. Throughout the entire Northwest, generally speaking, collections are more or less difficult and liquidation of debts and bank loans is slow. Efforts are being made to operate on the smallest possible stocks.

**Vacuum Cleaners.**—To meet spring requirements, in Seattle and Tacoma particularly, an improvement in demand has been noted during the past few weeks.

**Schedule Material.**—An increasing amount of construction, both residence and business buildings, is serving to move heavy stocks. This demand is expected to show constant increase throughout the summer and fall.

## SALT LAKE CITY—DENVER

That conditions should be much improved by next fall, particularly from the farmer's point of view, is indicated in the prospect for big crop yields. The acreage in some crops will be materially less than a year ago, owing to high cost of production, but the promise of heavy yields is very encouraging. Wages paid to farm help are at least 50 per cent under the standard wage of a year ago.

The wool outlook is little improved, with growers still holding their clippings for prices that at least approximate the cost of production. A vigorous co-operative movement in the way of pooling this wool promises to bring alleviation in the near future. Growers are still making a frantic effort to get loans to tide them over the period of demoralized markets. Country banks are interceding for their clients in appeals to the banks of the larger centers, and they are meeting with indifferent success. There are abundant signs of activity in building and construction lines. Hardware dealers, for example, report that last week showed the biggest volume of business of any week for the entire year. The lumber trades also report steady improvement. Many homes are under construction. With the advent of fair weather dealers report a noticeable improvement and feel confident of a good summer ahead.

**Washers.**—There is not much activity reported. Jobbers are overstocked and dealers are reluctant about ordering in sizable quantities.

**Cleaners.**—In this line it is a different story. Cleaners are selling well. In certain popular makes jobbers are hard put to it to keep their dealers amply supplied. They report a turnover of stocks in some instances every two weeks. Retailers are placing good-sized orders. Price guaranteeing also affects vacuum cleaners.

**Hollow Ware.**—The general movement in cooking appliances has been slow and unsatisfactory.

# Manufacturers' Activities

**Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature**

## New Buildings for Grindle Fuel Equipment Company

The Grindle Fuel Equipment Company, 1901 South Rockwell Street, Chicago, is offering, subject to prior sale, the unsold portion of $500,000 in 7 per cent cumulative and participating preferred stock at a par value of $50 a share, together with a bonus of one share of common stock. The proceeds of this sale will be used for additional working capital and for the construction and equipment of a new two-story factory building and a one-story foundry building. The plant will be used for manufacturing and demonstrating coal-handling machinery and equipment and coal-pulverizing equipment, in addition to gray-iron castings for the market.

## Newark Jobber Puts Out First Issue of Trade Letter

Devoting itself to the electrical interests of New Jersey, the Newark Electrical Supply Company, 223 Market Street, Newark, has issued Volume I, No. 1, of *Nelectra-Grams* of trade news and gossip. In this issue the company records an upward swing of business which made itself felt in April and states that it has received from every direction reports of a slow but perceptible increase in buying.

## More Details to N. E. C. A. Richmond Program

Following a tour of Washington, D. C., on Wednesday, May 18, including an address by D. R. Crissinger, Comptroller of the Currency, on "The Economic Problem," the National Electrical Credit Association will proceed to the Hotel Jefferson in Richmond, Va., for its twenty-second annual convention set for Thursday and Friday, the nineteenth and twentieth. During the period time is given for trips through historical country.

In Thursday's program William L. Goodwin, Society for Electrical Development, will lead the discussion on the "Sales Manager's Viewpoint of the Credit Department"; W. J. Drury, sales manager of the Western Electric Company, leads the discussion on the "Effect on Sales of a Rigid Credit Policy." "Better Business Methods" has been assigned to J. A. Corcoran, General Electric Company, and the discussion on "Present-Day Credit and Collection Problems and How to Meet Them" is to be led by T. J. Whearty, National Carbon Company. The annual dinner on Thursday evening will be addressed by John M. Miller, president of the First National Bank, Richmond; William L. Goodwin and Albert H. Elliot, secretary Pacific Coast Association.

To J. S. Thomas, Elliott-Lewis Electric Company, Philadelphia, has been assigned the discussion on "Is the Credit Man a Business Builder?" which is scheduled for Friday morning. James A. Loring, secretary New England Association, will lead the discussion on "Handling the Slow and Embarrassed Customer," and time will be given to association problems, marketing household devices, etc. This program is somewhat fuller than that published on April 16.

From information received as to the members who will attend, it seems there will be the largest and most enthusiastic gathering that has ever been seen at an annual meeting of the association. Was there ever a time more suited to credit discussions than right now?

## Larger Quarters for Flexible Coupling Manufacturer

The move of the Thomas Flexible Coupling Company, manufacturing engineers, from Warren, Pa., to Dunkirk, N. Y., was necessitated by the rapid growth of the business, according to one of the officers of the company. The new plant at Dunkirk is 40 ft. x 200 ft., on the main line of the New York Central, and is being equipped with the machinery best suited for its particular class of work. It is expected to begin operations by June 1.

The secretary states that the company has every reason to be optimistic, as business in its line is not at all bad. When conditions in general return to normal, and they are doing so very rapidly, he asserts, the company will be in a position to manufacture on a service basis with equipment for a large amount of new business.

## Gear Manufacturers Progress in Standardization

The American Gear Manufacturers' Association, which closed its annual meeting in Cincinnati on April 30, adopted as recommended practices by the association the reports of several committees. Uniform cost accounting was recommended as an important step in the coming year's program.

Special emphasis was laid on standardization of steel roller chains for transmission purposes, particularly in the matter of interchangeability; certain features in spur and bevel gears for industrial use were adopted as standard, and consideration was given to reports on railway gears and pinions, herringbone gears, keys, keyways, shafts, sprockets, etc.

F. W. Sinram, Van Dorn-Dutton Company, was re-elected president of the association; R. P. Johnson, Warner Gear Company, was elected first vice-president; B. F. Waterman, Brown & Sharpe Manufacturing Company, was elected second vice-president, and Frank D. Hamlin, Earle Gear & Machine Company, was re-elected secretary and treasurer, The executive committee was increased from nine to twelve members to take in all branches of the gear-making industry. The fall meeting will be held in Rochester, N. Y.

## Time Extended on New York Edison's Sign Show

Before the first day of the New York Edison Company's Electric Sign Show was over the exhibitors were so satisfied with results that they asked and received permission to extend the time of closing from 6 o'clock to 10 o'clock in the evening and the duration of the exhibit from May 7 to May 11. The original hours were from 9 a.m. to 6 p.m. and the dates from May 2 to 7 inclusive. Not only signs but also the latest in lamps, flashers, color caps, time switches and other accessories were shown.

The success of the show was assured from the first not only by the interest displayed but by the orders taken by the exhibitors. The attendance was exceedingly good in spite of inclement weather, and manufacturers are desirous of having the idea followed in other cities. Not the least interesting aspect to the central station was the spectacular effect of the motion of color, and as in other exhibitions it was especially noticeable in this case that visitors to the show had ample opportunity to see and inspect the various socket household appliances occupying otherwise unused spaces in the showroom.

## Two New Divisions Added to Wood Electric Company

The Harry I. Wood Electric Company, Louisville, Ky., manufacturer and jobber in electrical supplies, has added a farm-lighting division and an appliance division, both in charge of R. C. Bryce. Not only will the "Universal" light plant be promoted but also a good deal of attention will be devoted to the installation of units of the semi-Diesel type for larger municipal requirements.

In the appliance end Mr. Bryce will handle the "Mola" electric washer, the "Universal" electric washer, a complete line of Hamilton-Beach products, a complete line of "Edison" appliances, "Simplex" ironers, "Bee" vacuum cleaners and other home devices. The company hopes with sound business methods and service to extend its dealer connections beyond its present territory of Kentucky, Tennessee and southern Indiana.

## New Salt Lake City Electrical Manufacturing Company

Articles of incorporation have been filed by R. Ackerman & Company, Salt Lake City, organized for the purpose of dealing in and manufacturing various kinds of electrical equipment. The company has a capital stock of $100,000, divided into 1,000 shares of a par value of $100. Shares subscribed for by the various incorporators are paid for by the acquisition of the assets of the Kaiser, Ackerman, Gardner Company, valued at $14,000, to which the new company is successor, and certain other contributed assets. The incorporators are R. Ackerman, president; J. B. Ambler, vice-president; L. J. Riter, secretary-treasurer, and others.

## British Standardization in Cable Soldering Sockets

The British Engineering Standards Association, 28 Victoria Street, London, has issued a standard specification for electric cable soldering sockets. It deals with sockets for cables from 0.0018 sq.in. to 1 sq.in. sectional area and has been prepared at the request of the Institution of Electrical Engineers. The specification includes definitions and clauses relating to the material and dimensions of cast and wrought lug sockets and clamp sockets and their clamps. At present there are only two types of sockets standardized.

Attention is directed to the care which should be taken to insure that the cable should fit the hole in the sockets without too much clearance, so that the current will not have to traverse an undue amount of solder. For each size of cast lug socket a maximum diameter of hole is specified, and for use with smaller cables a smaller hole should be used. In the case of wrought lug sockets made from copper tubing it is not so easy to overcome this difficulty.

In the case of clamp sockets there are only nine sizes, and the actual diameter of the hole to be bored for each size of the cable is specified. The question is of chief importance when the maximum current is being carried.

## American Radium Files Complaint on Infringement

The American Radium Company, 7 East Forty-second Street, New York City, filed a bill of complaint in the Southern District Court of New York on April 26 for the infringement of its United States patent No. 789,812, originally granted to Dr. George F. Kunz, New York City, on luminous composition.

This equity suit is brought against the Hipp, Didisheim Company, Inc., and Hippolyte Didisheim and Henri M. Didisheim. The bill of complaint shows that it is also aimed at the partnership Hipp, Didisheim & Brother as the predecessor of the company, which was formed in April, 1919. Luminous composition is being used for pendent switches, push-buttons, etc., in the electrical field.

## Secretaries Hughes and Hoover Indorse China Trade Act

Both Secretary of State Hughes and Secretary of Commerce Hoover, according to advices from the Department of Commerce in Washington, have indorsed the China trade act, a bill designed to place American business in China on an even competitive basis with the business of Great Britain, France and Japan. "The matter is one of great importance to the preservation of the trade and investments of our nationals in China," says Secretary Hoover in a letter. "The act is intended to establish a federal incorporation law for local China business in such a manner as to give our citizens an equality of opportunities with other nationals."

Mr. Hoover explained that the object of the act is to offer a form of American corporation law that would rank with the British law in its protection to stockholders and would give American business in China a prestige which it does not now possess. The proposed act also provides freedom from United States taxes to such corporations upon such part of their business as is wholly conducted in China and outside of the United States.

The bill has been passed by the House and has been sent to the Senate.

## Power Specialty Company Expands Sales Offices

The Power Specialty Company, manufacturer of Foster superheaters, economizers and oil stills, has opened additional offices in the Reliance Building, Kansas City, Mo., and in the Linz Building, Dallas, Tex. The Kansas City office is in charge of William F. Meyer and the Dallas office in charge of M. W. Brown.

**The Newport News Battery & Electric Company**, Newport News, Va., is planning to install additional machinery at its plant.

**The Allen-Bradley Company**, 284 Greenfield Avenue, Milwaukee, announces the removal of its Cleveland office from the Citizens' Building to the Bangor Building, 942 Prospect Avenue. The Cleveland office is in charge of H. A. Stevenson, who is assisted by W. L. Jaeckel.

**The World Lighting Appliance Company**, 108 West Fortieth Street, New York City, has filed notice of increase in capital stock from $15,000 to $50,000.

**The Bates Company**, New York City, announces the removal of its engineering offices from 2 Rector Street to 74 Dey Street, where it will occupy the first and second stories.

**The Lytle Electric Company**, Memphis, Tenn., has applied for amendment to its charter to increase the capital stock from $10,000 to $25,000.

**The Non-Breakable Battery Cell Company**, Oconto Falls, Wis., recently incorporated with a capital stock of $30,000, has leased quarters in an existing factory and is purchasing equipment.

**The French Battery & Carbon Company**, Madison, Wis., has increased its capital stock from $675,000 to $1,750,000. The company, it is understood, contemplates increasing the capacity of its plant. James B. Ramsey is president.

**The Olive Hill Refractories Company**, Ashland, Ky., recently organized, contemplates the construction of a new plant with daily output of about 30,000 firebrick and other refractory shapes. John F. Hagar is president.

**The Keller Pneumatic Tool Company**, Grand Haven, Mich., has removed its Chicago branch to the Transportation Building, 624 South Dearborn Street. The salesroom and service station will be on the main floor. A complete stock of tools and parts will be carried. J. C. Campbell is district manager.

**The Mattison Machine Works**, Rockford, Ill., announce the removal of their New York office from 110 West Fortieth Street to 602-603 Times Building, Broadway at Forty-second Street.

**The Cortlandt Engineering Company**, Paterson, N. J., announces the removal of its offices from 11 Park Avenue to 193 Ellison Street, Paterson.

**The Uehling Instrument Company, 71** Broadway, New York City, manufacturer of fuel-saving equipment, has removed its Chicago office to the Great Northern Building, 20 West Jackson Boulevard. Uehling $CO_2$ recording equipment and other boiler instruments will be on display in this office. Walter C. Lange, until recently with the New York office, has been appointed manager of the Chicago office.

**The Superheater Company**, New York City, has removed its offices from 30 Church Street to 17 East Forty-second Street.

**The Michigan Stamping Company's** new address is Mack Avenue and Terminal Railroad, Detroit, Mich.

**The Lunkenheimer Company**, Cincinnati, Ohio, announces the removal of its Chicago branch from 188 North Dearborn Street to 568 West Washington Boulevard.

**The Sampson Manufacturing Company, 4244 West Lake Street, Chicago,** manufacturer of electric and gas fixtures, has completed plans for the erection of a one-story plant, 40 ft. x 125 ft., on West Lake Street, to replace a building recently destroyed by fire.

**The George H. Gibson Company**, New York City, consulting engineers, specializing in commercial research and advertising of technical products, announces the removal of its offices from the Tribune Building to the Hide and Leather Building, 100 Gold Street.

## Foreign Trade Notes

BRITISH CABLE MANUFACTURER EXPANDS WORKS.—In the 1920 report of the British Insulated & Helsby Company the profit for the year amounted to £340,713, an increase of £12,024 over 1919. Except for a coal strike and labor demands which closed the works for three weeks, the plants at Prescott and Helsby were busy throughout the year, and the present state of the order book is quite satisfactory. Present high costs of manufacture and inability to give certain delivery, owing to labor unrest, prevented the company from taking orders, which are now being placed abroad. Foreign trade can only be retained by a reduction in the cost of production, and although a decrease in wages would have a most beneficial effect, another and very important element has to be considered—namely, increased efficiency in the mechanical means of production. There has, therefore, been carried out a reorganization of the works. What are practically three new factories have been built and fitted with all the latest appliances and the power plant has been enlarged. Facilities for handling raw material and finished products have been much improved, while other departments have also been dealt with. These changes should cheapen production. The company has been working under the improved conditions for two or three months, and while it is feeling the beneficial results of the changes generally, it is noteworthy that all the latest types of special high-tension cables of very long lengths can be turned out.

SWISS COMPANY'S OPERATIONS IN RUSSIA.—The Swiss Company for Electrical Enterprises, at Glarus, Switzerland, a large holding company interested in a number of foreign electric establishments, has just published a report about the extensive electric plants of the Petrograd Electric Company. It seems that the works at Petrograd and Moscow have been in operation to a certain extent and that even some enlargements of the Moscow plant have taken place. The works at Lodz, also belonging to the Petrograd company, are being worked by the Polish authorities, who mean to operate this plant independently of the Petrograd company. The Lodz electric works have booked large orders of late and the prospects are very satisfactory. The Petrograd and the Moscow establishments are in the hands of the soviet government.

SUPPLIES WILL BE NEEDED IN SALVADOR.—The market in Salvador for electrical supplies is developing, according to a report from the Guaranty Trust Company. The municipality of Santiago de Maria and the city of Berlin, both in the Department of Usultan, have recently let a contract for an electric light plant.

REBUILDING LAMPS IN SCOTLAND.—According to advices from the British Consulate General in New York premises have been acquired in Paisley by the Scottish Electric Lamp Repairing Company for the establishment of this new industry in Scotland. The method of repair is to take a lamp of which the filament is worn or broken, cut out a small part of the glass, put in a new incandescent element, exhaust the air and weld up the glass again, the repaired lamp being virtually equal to a new one, while the cost is a fraction of that of a new lamp. The industry was commenced under patent protection by the Allies' Electric Repairing Company of Hammersmith, London, which has thoroughly tested and proved the soundness of the method and has now accorded the new company sole rights for Scotland.

SIEMENS & HALSKE'S 1919-1920 REPORT.—Siemens & Halske are now issuing their report for the business year 1919-1920. The combine with the Deutsch-Luxemburgische Bergwerks- und Hütten-Gesellschaft is now completed. The business year was fraught with economical uncertainty and the scarcity of raw material and coal could only be overcome toward the end of the year. After the last strike of the Berlin metal workers labor disturbances did not occur to any appreciable extent and the efficiency of the workmen increased, the good effect of piece work making itself felt. The expenditure in wages and salaries for the concern as well as for the Siemens-Schuckertwerke was 479,000,000 marks against 70,000,000 marks in 1914. This expenditure is estimated to run up to 1,000,000,000 marks in 1921. On Oct. 1, 1920, the company entered into a joint-interest combine with the Gelsenkirchener Bergwerks A.G., the Deutsch-Luxemburgische Bergwerks un Hütten A.-G. and the Electricity Company Schuckert & Company. The balance sheet shows a gross profit of 25,779,000 marks.

GERMANY'S EFFORTS TO REGAIN NORWEGIAN TRADE.—Germany is making great efforts to regain the Norwegian market for her electrical industry. According to a report from Christiania, Germany supplies at present about 25 per cent of all electrical machinery imported into Norway. At the same time imports from the United States in 1920 amounted to $2,165,000 worth of electrical materials and apparatus. The large importations from Germany are chiefly due to the depreciation of the German mark. Some of the large German electrical manufacturing concerns have recently opened branch offices at the Norwegian capital.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile firm in Spain (No. 34,796) desires to purchase and secure an agency from manufacturers only for the sale of electrical copper-wire bars for laminating; also copper blocks for laminating (weight to be in accordance with specifications), copper and brass in all forms, etc.

A firm in Mexico (34,797) desires to purchase a complete automatic call-telephone equipment, including receivers, transmitters, switches, 2 miles of wire, batteries, insulators, etc., for a six- to ten-party system.

An American firm with representatives and offices in China, Manchuria and Siberia (No. 34,799) desires exclusive agencies for lighting plants, power plants, etc.

An inquiry has been received from a business man in Chile (No. 34,803) for catalogs and full descriptions of fire and police alarm systems suitable for a city of 500,000 inhabitants.

## New Apparatus and Publications

BOILER CLEANER. — The Automatic Boiler Cleaner Company, New Orleans, has placed on the market a mechanical boiler cleaner for any type and size of boiler.

SIGN RECEPTACLE. — The Manufacturers'—Distributing Company, 30 Church Street, New York, is bringing out a new porcelain sign receptacle, the No. 54 "Mandico," all metal parts of which are of brass or copper.

FIXTURE STUD.—S. R. Fralick & Company, Chicago, have placed on the market a new fixture stud, known as the "Kwikon No-bolt" stud.

ENGINEERING CATALOG. — The seventh annual edition of "Sweet's Engineering Catalog" has been published by Sweet's Catalogue Service, Inc., New York City, listing in its 1,251 pages "materials, equipment and supplies relating to practical construction, equipment and maintenance of all projects of an industrial or engineering nature."

WINDOW LIGHTING. — The Ivanhoe Rainbow Window Lighting Equipment of the Ivanhoe Regent Works of General Electric Company, Cleveland, embracing color lighting for show windows is on the market.

CONVEYORS. — The Lamson Company, 100 Boylston Street, Boston, is distributing an eight-page leaflet describing its different types of conveyors.

ROTARY PUMP. — The Exeter Machine Works, Inc., West Pittston, Pa., have recently placed on the market a new "Exeter" rotary pump (Feuerheerd Patents).

LUBRICATION.—"Turbine Lubrication," Part 2, is the subject of the leading article in the April, 1921, issue of *Lubrication*, published by the Texas Company, 17 Battery Place, New York City.

STOKERS.—The Combustion Engineering Corporation, 11 Broadway, New York City, has issued bulletin C-2, describing the Coxe stoker. The company is also distributing two pamphlets, one entitled "Use of Pulverized Coal Under Central Station Boilers" and the other "Powdered Coal Application to Four 2640-Hp. Boilers."

## New Incorporations

THE GEORGETOWN ELECTRIC LIGHTING COMPANY, Georgetown, N. Y., has been incorporated to operate a local light and power system. C. D. Brown, A. A. Watson and E. L. Andrus are interested in the company.

THE SLATON LIGHT COMPANY, Slaton, Tex., has been organized to operate a local electric system. Foster Carroll and L. H. Fuller are interested in the company.

THE TOMPKINS COUNTY POWER CORPORATION, Ithaca, N. Y., has been incorporated with a capital stock of $20,000 to install and operate an electric light system in certain sections of Tompkins County. The incorporators are W. E. Towner, E. F. English and H. H. Brown, Ithaca.

THE LELAND ELECTRIC COMPANY, Dayton, Ohio, has been incorporated with a capital stock of $10,000 to manufacture fractional-horsepower motors. George H. Leland is interested in the company.

THE DIXIE LIGHT & POWER COMPANY, Walton, Ky., has been incorporated with a capital stock of $20,000 by Robert W. Jones, William Brittenheim and Charles Ransler.

THE LA ELECTRIC & FIXTURE WORKS, 1910 South Main Street, Los Angeles, Cal., has been organized to manufacture electric fixtures, etc. Capitola La Touche, 2006 South Union Avenue, heads the company.

THE SALTVILLE (VA.) ELECTRIC COMPANY has been incorporated with a capital stock of $10,000. J. K. Wilson is president and E. C. Scott is secretary.

THE COMMUNITY POWER COMPANY, Petersburg, W. Va., has been incorporated with a capital stock of $50,000 by A. J. Welton, H. W. Sites and Charles J. Zell.

THE NESCO ELECTRIC SERVICE COMPANY, New York, N. Y., has been incorporated with a capital stock of $75,000 to manufacture electrical apparatus. The incorporators are N. Xenakis and J. C. Papadopoulos, 2033 Broadway.

THE H. L. ELECTRIC COMPANY, New York, N. Y., has been incorporated by M. L. Wack and O. I. Jubelsohn, 36 East Eighth Street. The company is capitalized at $10,000 and proposes to manufacture electrical equipment.

THE WILLYS LIGHT HOME EQUIPMENT COMPANY, Fremont, Ohio, has been incorporated with a capital stock of $10,000 by M. G. Throves, A. J. Vickery and J. L. Patterson.

THE ALP ELECTRIC MANUFACTURING COMPANY, 325-27 East Ferry Street, Newark, N. J., has been incorporated by Mauritz Larsen, Eric H. Anderson and Walfred A. Peterson. The company is capitalized at $100,000 and proposes to manufacture electrical products.

THE SPERLICH & UHLIG COMPANY, Detroit, Mich., has been incorporated by J. Herman Uhlig, Edward F. Wunch and Herman A. Sperlich, 44 Colorado Avenue. The company is capitalized at $300,000 and proposes to manufacture electrical appliances and equipment.

THE ELECTRO HEATER COMPANY, Silver Springs, Md., has been organized to manufacture lighting and heating equipment. Harry E. P. Baden, Silver Springs, and Jay L. Benedict, Washington, D. C., are interested in the company.

THE ELECTRICAL BATTERY & WELDING COMPANY, 2426 Prairie Avenue, Chicago, Ill., has been incorporated by George L. Kyle, C. L. Gotschall, A. C. Flynn, Paul T. Lamoreaux and J. E. Hurtubise. The company is capitalized at $10,000 and proposes to manufacture storage batteries, armatures, dynamos, ignition systems, etc.

THE LOGAN MACHINE & ELECTRIC COMPANY, Logan, W. Va., has been incorporated by S. S. and C. F. Smith and H. E. Steele, Logan. The company is capitalized at $25,000 and proposes to manufacture electrical equipment, machine parts, etc.

THE NEWBERRY ELECTRIC CORPORATION, Los Angeles, Cal., has been incorporated by R. C. S. Pilsbury, J. N. Hayes and D. D. McFarlane. The company is capitalized at $200,000 and proposes to manufacture electrical products. H. C. Galloupe, 1326 Washington Building, heads the company.

# Record of Electrical Patents

**Notes on United States Patents**

(Issued April 19, 1921)

1,375,256. IGNITION APPARATUS FOR AVIATION ENGINES; Auguste Maire, Argenteuil, France. App. filed Aug. 9, 1917.

1,375,276. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 28, 1918. Trunk-line circuits.

1,375,277. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed June 5, 1919. Machine switching.

1,375,278. INCLINE INDICATOR; William S. Clayton, Vancouver, B. C., Canada. App. filed Sept. 5, 1918. For aviation.

1,375,281. TELEGRAPH SYSTEM; George C. Cummings, East Orange, N. J. App. filed May 28, 1918. Simultaneous transmission of messages over one line.

1,375,306. BATTERY ELECTRODE; Lorenz Maisel, Madison, Wis. App. filed Oct. 11, 1918. Container type.

1,375,309. ELECTROGALVANIZING MACHINE; Constantine G. Miller, Chicago, Ill. App. filed Feb. 3, 1920. Improved feeding mechanism.

1,375,317. PROCESS FOR FORMING SECONDARY-BATTERY PLATES; John M. Peterson, Dawson, Minn. App. filed Sept. 18, 1918. Planté type.

1,375,319. ELECTRIC MOTOR GENERATOR FOR STARTING AND LIGHTING GASOLINE AUTOMOBILES; Frank B. Rae, Cleveland, Ohio. App. filed June 7, 1915.

1,375,330. MANUFACTURE OF METALLIC SODIUM; Albert W. Smith and William R. Veazey, Cleveland, Ohio. App. filed July 16, 1917. Electrolytic.

1,375,351. CALL-DISTRIBUTING ARRANGEMENT FOR TELEPHONE PLANTS; Gotthilf A. Betulander, Sodertorns Villastad, Sweden. App. filed Nov. 23, 1920. Automatic or semi-automatic.

1,375,357. ELECTRIC WATER HEATER; Cyrus M. Bosworth, Lakewood, Ohio. App. filed Feb. 7, 1920. Resistance element in water circuit.

1,375,360. APPARATUS FOR VULCANIZING RUBBER; Wilbur B. Burke, Cleveland, Ohio. App. filed Feb. 16, 1916. Electric heating element.

1,375,367. DETECTOR SIGNAL; Sidney Dawson, Chicago, Ill. App. filed May 31, 1917. Thief detector.

1,375,393. HIGH-FREQUENCY MOTOR ALTERNATOR; George A. Johnstone, Chicago, Ill. App. filed Oct. 7, 1918. Field wireless telegraph.

1,375,405. APPARATUS FOR TESTING CAPACITY OF ELECTRIC CONDUCTORS; William H. Martin, New York, N. Y. App. filed Jan. 22, 1918. Loaded telephonic cable circuits.

1,375,412. ELECTRICAL COLLECTOR; Jacob M. Olinger, Springfield, Ohio. App. filed Oct. 27, 1919. Trolley.

1,375,414. APPARATUS FOR TESTING CAPACITY DEVIATIONS AND UNBALANCE OF ELECTRIC CONDUCTORS; Harold S. Osborne, New York, N. Y. App. filed Jan. 22, 1918. Loaded telephonic cable circuits.

1,375,437. LONG-DISTANCE SIGNAL AND CONTROL SYSTEM; Walther Akemann, Essen, Germany. App. filed Sept. 3, 1920. Synchronously acting, transmitting and receiving system.

1,375,438. LONG-DISTANCE CONTROL AND SIGNAL DEVICE; Walther Akemann, Essen, Germany. App. filed Sept. 3, 1920. Synchronous movement of pointers.

1,375,447. MEANS FOR AMPLIFYING CURRENTS; Lee de Forest, New York, N. Y. App. filed June 24, 1913. Reproducing sounds from magnetic sound records.

1,375,461. INDUCTION MOTOR; Austin Kimble, Wausau, Wis. App. filed May 12, 1919. Each bar consists of a core of high-reactance metal and a sheath of low-impedance metal.

1,375,465. DEVICE FOR CONVERTING SOUND OR OTHER VIBRATIONS INTO VARIATIONS IN AN ELECTRICAL CIRCUIT; Charles R. Moore, East Orange, N. J. App. filed May 18, 1918. Mine detector.

1,375,474. PHOTO-ELECTRIC APPARATUS; Walter O. Snelling, Allentown, Pa. App. filed July 9, 1920. Light-sensitive selenium cells.

1,375,481. POWER MODULATOR FOR RADIOTRANSMISSION; Harold D. Arnold, East Orange, N. J. App. filed Aug. 23, 1915. With a minimum of distortion.

1,375,486. ELECTRICAL SYSTEM AND CONTROL THEREFOR; Arthur R. Bullock, Lakewood, Ohio. App. filed Aug. 2, 1917. For rectifying alternating current.

1,375,508. ADVERTISING AND OTHER DEVICE; Henry K. Harris, Westminster, London, England. App. filed Aug. 14, 1917. Parts brought into successive positions.

1,375,516. ELECTRIC ALARM SYSTEM; Christian J. Jenne, San Francisco, Cal. App. filed Nov. 2, 1916. Fire, burglar and police alarm.

1,375,518. CIRCUIT-RESTORING RELAY; Charles W. Kautz, Jr., Lancaster, Pa. App. filed Jan. 27, 1919. Predetermined number of automatic restorations.

1,375,544. ELECTRIC EMBOSSING-PLATE HEATER; Sidney M. Weatherly and Howard J. Stach, Hartford, Conn. App. filed Aug. 16, 1918.

1,375,550. SEPARATOR FOR STORAGE BATTERIES; William Best, Kansas City, Mo. App. filed Dec. 10, 1919. Slate separator.

1,375,586. POCKET HAND LAMP; John Graves, Madison, Wis. App. filed Nov. 8, 1919. Novel switch.

1,375,587. POCKET HAND LAMP; John Graves, Madison, Wis. App. filed Nov. 10, 1919. Novel switch.

1,375,591. TROLLEY; Ludwig W. Kaempf, Fort Scott, Kan. App. filed Feb. 24, 1920.

1,375,596. MANUFACTURE OF PERBORATES; Johann K. Langhard, Fredriksstad, Norway. App. filed Feb. 6, 1920. Electrolytic.

1,375,599. TROLLEY-WIRE HOLDER; Frank Madrak, Duryea, Pa. App. filed May 2, 1918.

1,375,615. ELECTRIC FURNACE; Cesare Soncini, Pont St. Martin, Italy. App. filed April 12, 1920. For melting material in crucibles.

1,375,631. PROCESS OF SEPARATING AND REFINING METALS; Gustaf Haglund, Falun, Sweden. App. filed Dec. 5, 1918. Complex ores.

1,375,632. DRY CELL; Carl Hambuechen, Belleville, Ill. App. filed June 15, 1918. Means for spacing elements.

1,375,647. DEPOLARIZING BATTERY ELECTRODE AND PROCESS OF MAKING SAME; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed Aug. 22, 1918. Copper oxide depolarizer.

1,375,654. BINDING POST FOR STORAGE BATTERIES; Joseph J. Flood, East Orange, N. J. App. filed April 3, 1920. Connecting means between cover and post.

1,375,658. DYNAMO-ELECTRIC MACHINE AND BRUSH-HOLDER DEVICE THEREFOR; Clarence F. Gilchrist, Toledo, Ohio. App. filed July 9, 1917. Ready assembly and adjustment.

(Issued April 26, 1921)

15,094. REGENERATIVE BRAKING; George H. Hill, Schenectady, N. Y. App. filed Oct. 15, 1918.

1,375,675. SIGNALING METHOD AND SYSTEM; Edwin H. Colpitts, East Orange, N. J. App. filed Feb. 5, 1917. Between anchored balloon and ground.

1,375,687. APPARATUS FOR ELECTRIC WELDING; George H. Forsyth, Chicago, Ill. App. filed May 3, 1915. Over an extended area.

1,375,691. SELECTIVE SWITCH; Charles L. Goodrum, New York, N. Y. App. filed Sept. 8, 1917. Automatic telephone.

1,375,692. MACHINE-SWITCHING DEVICE; Charles L. Goodrum, New York, N. Y. App. filed Feb. 24, 1919. Automatic or semi-automatic telephone.

1,375,695. OVEN; Marshall W. Hanks, Mount Vernon, N. Y. App. filed Jan. 30, 1920. Electrically heated.

1,375,699. WEDGE OR KEY FOR SLOTTED DYNAMO-ELECTRIC MACHINE ELEMENTS; Max J. Ilg, Nuremberg, Bavaria, Germany. App. filed May 27, 1915. Magnetic.

1,375,707. TUNING OF DIAPHRAGMS FOR GENERATING OR RECEIVING SOUND WAVES; Louis V. King, Montreal, Quebec, Canada. App. filed April 1, 1919.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

MALDEN, MASS.—The Malden Electric Company has applied to the Department of Public Utilities for permission to issue 5,340 shares of stock at $125 a share, the proceeds to be used for the construction of a new plant and system, etc.

PLYMOUTH, MASS. — The Plymouth Electric Company has applied to the Department of Public Utilities for permission to issue $100,000 additional stock, the proceeds to be used for additions and extensions to its plant.

DOVER, N. H.—The Twin State Gas & Electric Company has arranged for a note issue of $1,000,000, part of the proceeds to be used for improvements and extensions to its plant and system. Samuel Insull is president.

## Middle Atlantic States

NEW YORK, N. Y.—The Department of Public Markets, Municipal Building, is considering the construction of a new terminal market, including an electric power plant, refrigerating and ice plant, etc., to cost about $5,000,000.

NIAGARA FALLS, N. Y. — The City Council contemplates the installation of an ornamental lighting system on First Street from Cherry Street to Niagara Street. Electrical service is furnished by the Niagara Falls Power Company.

PENN YAN, N. Y.—The Yates Electric Light Company is considering furnishing electrical service in Branchport, Pulteney Landing on Lake Keuka, and in the village of Prattsburg.

MILLVILLE, N. J.—The City Commission has authorized W. E. S. Temple, city electrical engineer, to prepare plans for a municipal electric plant.

AMBRIDGE, PA.—The Columbia Steel & Shafting Company, Carnegie, plans to build a new local plant. Considerable electrical equipment will be required. Th cost is estimated at about $3,000,000. Hopkinson & Schaeffer, 500 Marion Building, Cleveland, Ohio, are architects.

EAST BROOK, PA. — A committee has been appointed to confer with the New Castle Electric Company in regard to extending its electrical service to East Brook. Louis Round is manager of the company.

LANGSHORNE, PA. — The Langshorne Electric Light & Power Company plans to abandon its plant and erect a transmission line from Langshorne to connect with the system of the East Pennsylvania Gas & Electric Company, Bristol.

PHILADELPHIA, PA.—H. H. Kline, architect, 1612 South Fourth Street, is preparing plans for the construction of a new one-story power house to be used in connection with a dye works at 5100 Lancaster Avenue. Bids, it is understood, will be asked at an early date.

PHILADELPHIA, PA.—Bids will be received at the office of the Constructing Quartermaster, Frankfort Arsenal, Philadelphia, Pa., until May 17, for the installation of an electric lighting system in the new experimental shop building.

PITTSBURGH, PA. — Application has been made to the Public Service Commission for a merger of thirty-seven electric companies operating in Clarion, Armstrong and other adjoining counties, with the West Penn Power Company, which will allow the latter to extend its facilities and operations throughout this district. The company has also applied for permission to acquire the entire capital stock of the Clarion Electric and Red Bank Electric Companies.

WILMINGTON, DEL.—The City Harbor Commission contemplates the construction of new terminal wharves and docks to cost

about $1,750,000. Electrically operated hoisting machinery, electrical traveling cranes and other such equipment will be required.

BALTIMORE, MD.—Engineers employed by the city to investigate the waterworks system have submitted a report to the Water Bureau recommending the erection of a new electrically operated pumping plant near Lake Montebello, to cost about $850,000.

WASHINGTON, D. C.—Bids will be received at the office of A. L. Flint, general purchasing officer, the Panama Canal, Washington, D. C., until May 25, for furnishing steel rope, copper cable, electric range, dry batteries, dynamometers, magnet wire, fuses, commutator resurfacers, cable grips, motors, plugs, etc. Blanks and information relating to this circular (1448) may be obtained from the above office or the offices of the assistant purchasing agent, 24 State Street, New York City.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, Washington, D. C., until May 26, Circular PR 6840-3ACP, for storage batteries in lots from 1,200 to 2,500 and in lots from 300 to 1,500; also metal cases for storage batteries in lots of from 300 to 750.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids for furnishing the following: Until May 27, Puget Sound, Schedule 7989—miscellaneous quantity of wire and cable; Portsmouth, Schedule 8022—eight each motors and controllers.

## North Central States

DETROIT, MICH. — The Ford Motor Company has been granted permission by the Council to erect a high-tension transmission line between its River Rouge and Highland Park plants.

COLUMBUS, OHIO.—Plans are under way for the construction of a new power plant at the Ohio State University, to cost $380,000 with machinery. Carl E. Steeb is secretary.

LOUISVILLE, KY.—The Louisville Gas & Electric Company recently acquired land, and plans eventually to make large additions. No work will be started this year.

PADUCAH, KY. — Contract has been awarded to the Paducah Electric Company for the installation of a new lighting system in the downtown district of the city.

WHITE HALL, ILL.—The construction of a municipal electric lighting plant to cost about $75,000 is under consideration. H. W. Roodhouse is a member of the city board.

WONEWOC, WIS.—The Baraboo Valley Utilities Company, Wonewoc, contemplates the erection of a transmission line from Elroy to Kendall, New Lisbon and Camp Douglas, a distance of between 40 and 50 miles. The project may include the construction of two new power houses. A. P. Gale is secretary.

KANSAS CITY, MO.—Steps have been taken by the Fifteenth Street Commercial Club to raise funds for the installation of an ornamental lighting system on a portion of Fifteenth Street.

MARYVILLE, MO.—The Maryville Electric Light Company plans to double the output of its plant. New equipment, including a 600-kw. turbine and steam condensing apparatus, will be installed. The cost is estimated at about $30,000.

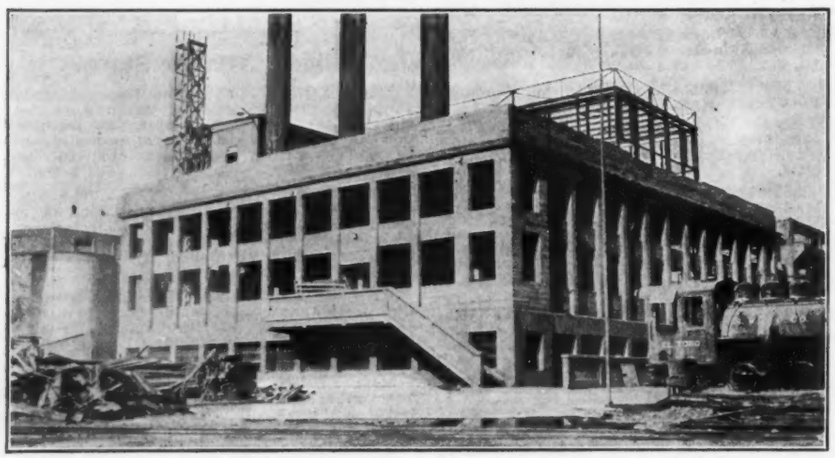
UNIONVILLE, MO.—Bonds to the amount of $84,000 have been voted for an electric light and water plant and filtration system.

WESTPOINT, NEB.—At a special election to be held May 24 the proposal to issue $58,000 in bonds for the construction of a municipal light and power plant will be submitted to the voters.

WILSONVILLE, NEB.—The proposal to issue $20,000 in bonds for the erection of an electric transmission line to connect with the municipal light plant at Cambridge is under consideration.

## Southern States

ASHEVILLE, N. C.—The French Broad River Development Company, Henderson, is planning to build new hydro-electric power plant on the French Broad River in the vicinity of Asheville, with an initial capacity of 10,000 hp. J. H. Pratt, Chapel Hill, is engineer.



NEW WASTE-HEAT BOILER PLANT OF SOUTHWESTERN PORTLAND CEMENT COMPANY, EL PASO, TEX.

This plant is now in operation, and it is proposed later to add additional generating equipment

BLOWING ROCK, N. C.—W. L. Alexander contemplates the installation of a power plant to develop 50 hp. for lighting purposes. Laundry equipment will also be installed.

WINSTON-SALEM, N. C.—The city has entered into contract with the Southern Public Utilities Company for the installation of a new street-lighting system consisting of 350 lamps of 150 cp., 220 lamps of 250 cp. and 250 lamps of 400 cp. The contract also provides for ornamental lighting system in the business section of the city.

AUGUSTA, GA.—Plans, it is reported, have been prepared by Lockwood, Greene & Company, 101 Park Avenue, New York City, for the city of Augusta for electrification of canal. It is proposed to organize a company to be known as the City of Augusta Power Corporation, and to issue $5,000,000 in bonds for the project.

CORDELE, GA.—Bonds to the amount of $40,000 have been voted for the construction and equipment of an electric light and power plant. W. G. Webb is engineer.

MORRISTOWN, TENN.—The Council is considering an issue of $15,000 in bonds for extensions to light and water systems. J. J. Thompson is town recorder.

DE QUEEN, ARK.—An independent light company will be organized in De Queen, with a capital stock of $50,000. The present plans provide for the erection of a transmission line by the Dierks Lumber & Coal Company from its plant at Dierks to De Queen to supply the new company with electricity.

WELEETKA, OKLA.—Plans are under consideration for additions to the local electric light plant. C. C. Long & Company, 1300 Colcord Building, Oklahoma City are engineers.

EL PASO, TEX.—The city planning committee of the Chamber of Commerce has indorsed recommendations relative to the installation of an ornamental street-lighting system in the business district of El Paso.

## Pacific and Mountain States

SEATTLE, WASH.—The Lighting and Power Department, it is understood, has issued a call for bids for furnishing 315 miles of copper or aluminum wire for the proposed transmission line from the Gorge Creek plant to Seattle. C. F. Uhden is chief engineer of the Skagit hydro-electric project.

STEPTOE, WASH.—The Steptoe Light & Power Company has been granted a franchise by the commissioners of Whitman County to erect a transmission line from Steptoe to Elberton, where it will connect with the Washington Power Company's line from Spokane.

WENATCHEE, WASH.—The Royal Development Company has applied to the Federal Power Commission for two small power installations on tributaries of Phelps Creek in Chelan County. Each plant will consist of a low diversion dam and a short length of pressure pipe to a 100-hp. plant to be situated at the mouth of two mines. James Naughton is president.

YAKIMA, WASH.—Residents of Naches Heights and other adjoining sections of the Tieton power project plan to erect a transmission line to secure electricity from the Pacific Power & Light Company.

PORTLAND, ORE.—Reconstruction plans and improvements under way and contemplated on the interurban lines of the Portland, Railway, Light & Power Company within the next few months will cost more than $200,000. This is exclusive of the reconstruction of a large wooden trestle at a cost of $150,000.

LAYTON, UTAH.—The Utah Light & Power Company has filed application with the Public Utilities Commission for a certificate of convenience and necessity to serve the town of Layton.

PROVO, UTAH.—A. N. Taylor of Provo has filed application with the state engineer for an appropriation of 20 sec.-ft. of water from the Provo River. The diversion works will consist of a dam in each branch of North Fork Creek, a diversion channel about 21,300 ft. long, and two Pelton-type waterwheels. Plans provide for the development of 2,227 hp. for distribution in Utah and Wasatch Counties.

WALES, UTAH.—A fifty-year franchise has been granted for the erection of an electric transmission line from Wales to the plant of the Big Springs Electric Company, Fountain Green.

BURLEY, IDAHO.—The Department of Interior has approved of a contract by which additional electric power will be obtained during the summer for the government project at Minidoka. The contract provides for the lease of the power house of the Boise project on the Boise River and the transmission of electricity from there to Milner over the lines of the Idaho Power Company. The Reclamation Service will erect a transmission line from Burley to Milner and install a substation to transform power received from 40,000 volts to 30,000 volts.

## Canada

TORONTO, ONT.—The private bills committee of the Ontario Legislature has passed a bill authorizing the city to install a cable for the civic railway at a cost of $31,650.

WALKERVILLE, ONT. — The Utilities Board contemplates extensions to the hydro-electric plant, to cost about $95,000. A. E. Cook is secretary.

CHARLOTTETOWN, P. E. I. — The Prince Edward Island Light, Heat & Power Company, capitalized at $2,000,000, is applying for a provincial charter to supply electricity to all parts of the island from one large central power house.